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Essays on Retailers' Private Label Portfolio:

Economy, Standard and Premium Private Labels

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door

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Gizem Hökelekli

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Chapter 1 General Introduction

As of the late 1990s, Private Labels (PLs) have been of interest to researchers in economics and marketing. They command attention and generate discussion primarily because of the manners in which they differ from National brands (NBs). PLs have been especially successful in Western Europe, where their share in the total consumption of packaged goods is as high as 45% (Nielsen 2014). Building the right PL program for the retailer is critical for its success in today's highly competitive grocery industry. A report by IGD demonstrates the recent shift in industry thinking that consumers are not only interested in the price of a product, but also in the quality values of a store's range (IGD 2011). Likewise, the Private Label Manufacturers Association (PLMA) states that "it is worthwhile for retailers to differentiate their PLs as 'low-cost', 'standard' and 'premium' products, in order to satisfy the heterogeneous nature of consumer demand as well as provide a 'quality' point of differentiation compared to competitors" (PLMA 2011). Therefore, retailers no longer treat their store brand as one homogenous group and are offering three-tier PL products, ranging from cheap and low quality own labels (i.e., budget PLs) to somewhat less expensive and comparable quality PLs (i.e., standard PLs), to premium quality and high value added PLs that are not priced lower than national brands (NBs) (i.e., premium PLs) (Kumar and Steenkamp 2007).

This dissertation extends the academic field by offering better insights in the popular retailers' three-tier PL programs instead of considering PLs as one homogenous group. Despite the enormous and still growing success of PLs, several issues remain largely unexplored. First, within PL tier strategy, recently an increasing number of leading retailers have extended their PL tier offerings with new lines targeted at distinct consumer segments (IPLG Europe 2014), such as health and kids lines (e.g. Good For You at U.K. retailer Asda and Conad Kids at Italian retailer

Conad). Likewise, U.S. retailer Kroger has expanded its organic and healthy (standard and premium) PL lines recently (Market Watch 2012).

The PL market challenges are very different for each of the three tiers: Industry observers increasingly state that economy PLs are facing important challenges for the industry. They are shrinking in volume sold as they fail to compete with discounters (IRI 2016). Moreover, they generate lower margins than standard PLs, and most importantly they can cannibalize the current PL offerings, which in turn leads to category profit erosion (ter Braak et al. 2013; IPLG 2016). Meanwhile, standard PL tier retains its popularity, and premium PLs are even growing, not only in size but also in value (IRI 2016). Together with the further proliferation in PL tier offerings, there is an ongoing discussion on how different PL tiers should be priced relative to each other and their NB competitors.

PL tiers play an important role for the traditional retailers not only to compete with each other but also with other retailer format such as discounters. The rise of the discounters is a key driver of structural change within the grocery retailing (The Independent 2014). Their market shares range from around 10% to an astonishing 43% in Germany (Global Retail Mag 2014) and they are estimated to grow further in the future according to grocery think-thank IGD (Food Manufacture UK 2015). They compete on price, quality, consistency and simplicity. Discounters apply a no-frills approach, products are often displayed on the floor on pallets and retail-ready; half-sized pallets are used to further optimize floor space (Cleeren et al. 2010; AT Kearney 2011). Their sales rely primarily on private labels (PLs) and, recently, they started offering a limited number of national brands (NBs). Above all, prices are very low. By economizing on assortment and service, discounters are able to offer their PL products at rock-bottom prices (Lin et al. 2012). For the traditional retailers, the gains made by Aldi and Lidl have been like the arrival of a new

predator (BBC 2015). The boss of UK-based Morrisons declared that the competition from discount grocers Lidl and Aldi has thrown the supermarket industry into its biggest crisis since its birth in the 1950s (The Independent 2014). To fight back against discounters, and to better compete with other retailers, traditional retailers started to view their PLs more strategically and began to explore new growth opportunities via multi-tier PL strategies (Food Navigator 2015).

While the popularity of PLs continues to grow, various government, regulatory and industry organisations have expressed their views on the impact of PL tiers on consumer welfare. Overall, economic theory and industry reports suggest that PL tier introductions benefit consumers, by providing them new products and improved value for money (Daskalova 2012). In addition to these direct benefits, consumers can be better off thanks to increased competition in the market since they force the incumbents' products to compete more vigorously in terms of offering higher quality, increased level innovation, and lower prices (Oxera 2010). On the other hand, the competition authorities have been increasingly concerned whether retailers could use PL tiers to harm competition by raising prices or reducing the shelf space available for NBs (Daskalova 2012). The current dissertation will therefore aim to shed more light on these issues as well.

Contribution of this Dissertation

This dissertation aims to contribute to the literature in multiple ways. To the best of our knowledge, we are the first to study the demand implications of (i) further *line* proliferation within PL tiers and (ii) different PL tier price settings. Moreover, besides the demand implications of further proliferation and price decisions within the multi-tier PL strategy, we derive what happens

to a retailer's profits, addressing the recent call for more PL studies on profit implications (see Sethuraman and Gielens 2014).

Second, our focus is to shed light on the role of PL tiers in the competition between hard discounters and traditional retailers. We identify (i) which PL tier is the most effective for the traditional retailers in the battle with the discounters; (ii) how traditional retailers should adjust the pricing of their PLs and NBs to respond to the discounter threat; and (iii) whether discounters should expand the NB presence in their stores to further steal demand from the traditional retailers? Our work builds on two streams of literature. The first stream focuses on PL tiers, but ignores competition across retailers. Therefore, we are – to the best of our knowledge – the first to investigate the inter-tier competition *across retailers*, by adding the retailer dimension in our study. The second related literature stream bears on retailer (format) competition, without considering the role of PL tiers. Hence, we are the first to systematically investigate the role of *PL tiers* in retailer (format) competition in the context of traditional versus discount retail formats.

Third, in contrast to previous literature that mainly focus on the sales and performance implications of the PL tiers either from the manufacturer or retailer side, this dissertation also focuses on the third party involved, the consumer. The European Commission has put consumer welfare at the top of its competition law objectives (Olbrich et al. 2009). Hence, the insights from this study can help competition authorities to assess whether the introduction of economy and premium PL tiers are welfare enhancing.

Dissertation Outline

This dissertation contains three main chapters that focus on (i) the impact of PL proliferation and pricing on consumer demand, (ii) the role of PL tiers in the competition between discounters and

traditional retailers and (iii) the impact of PL tier introductions on consumer welfare. Despite their common focus on impact of PL tiers, each chapter is self-contained and investigates the impact of PL tiers on different parties (e.g. retailer or consumers). Hence, they can be read independently. Each chapter starts with its own introduction and ends with a conclusion and/or discussion of the major findings.

Chapter 2- "*Private Label Line Proliferation and Private Label Tier Pricing: A New Dimension of Competition between Private Labels and National Brands*"- studies how do the different PL tiers/lines compete with each other and with the existing NBs in the assortment? And, how does this PL-NB competition influence consumer demand and retailer's profits? Recently, an increasing number of leading retailers have extended their PL tier offerings with new alternatives targeted to distinct consumer segments (IPLG Europe 2014), such as health and kids lines (e.g. Good For You at U.K. retailer Asda and Conad Kids at Italian retailer Conad). Likewise, U.S. retailer Kroger has expanded its organic and healthy (standard and premium) PL lines recently (Market Watch 2012). Hence, this PL proliferation to new quality tiers (i.e. economy, standard and premium) and the further line proliferation within each tier pose challenges to a retailer's PL-NB portfolio management and price setting. This chapter also takes into account whether retailers can set more competitive prices for their PL tiers to increase their profitability. For example, industry observers increasingly state that economy PLs are shrinking in volume sold since they fail to compete with discounters (IRI 2016). Moreover, they generate lower margins than standard PLs and most importantly they can cannibalize the current PL offerings that in the end leads category profit erosion (ter Braak et al. 2013; IPLG 2016). For this purpose, by using a representative household panel dataset (2008-2009) for the ready to eat (RTE) cereal category of two leading U.K. grocery retailers, we derive the demand and profit effects under the following set of scenarios:

(i) dropping or adding a line (kids, health or muesli) within a PL tier and (ii) changing the PL tier prices.

Chapter 3- "*The Battle of Traditional Retailers versus Discounters: The Role of PL Tiers*" investigates how PL tiers (i.e. economy, standard and premium) affect the competition between discounters and traditional retailers. For grocery retailers in Europe, intense competition from hard discount formats like Lidl and Aldi is an established part of the competitive landscape. As discount grocery retailers increasingly meet the needs of European consumers, traditional retailers are seeing their profits plummet and market shares shrink (BCG 2016). Due to the highly competitive retail environment, traditional retailers' private label (PL) tiers are now set to become the new battle ground in this competition. We use a representative UK household panel dataset (2009-2010) for the ready-to-eat cereal and canned soup category, and estimate a demand model for the choice between national brands (NBs) and PL tiers across the top-7 UK retailers. Using our demand estimates, we conduct several counterfactual experiments that predict consumer responses to different strategies of traditional retailers and discounters in their fight for the consumer. In particular, we compare the effectiveness of three types of PLs offered by traditional retailers to fight discounters: economy PLs versus standard PLs versus premium PLs.

Chapter 4- "*Do Consumers Benefit from an Economy and Premium Private Label Introduction? Evidence from the U.K.*" explores the consumer welfare effect of economy and premium PL introduction in the ready-to-eat cereal and soup category in the U.K. market respectively. While popularity of PLs keeps growing, the past decade has seen growing antitrust concerns about the impact of PLs on consumer welfare and competition in the grocery sector (Daskalova 2012). In fact, competition authorities in Europe increasingly raise their concerns around the effect of recent PL tier introductions on consumer welfare. In addition to NB pricing,

retailers have full control over pricing of PLs. PLs differ in size, nature and quality between supermarket chains which makes it difficult for consumers to engage in price comparison. This reduced transparency tends to soften price competition between the PLs of different retail chains and eventually harms consumer welfare (UK Competition Commission Grocery Market Inquiry 2008). Hence, considering the competition authorities' welfare concerns and the recent calls for more consumer welfare-oriented research by industry observers (Hyman et al. 2010), this study aims to shed light on the effect of PL tier introductions on consumer welfare.

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Chapter 2 Private Label Line Proliferation and Private Label Tier Pricing: A New Dimension of Competition between Private Labels and National Brands[1]

2.1 Introduction

One of the most salient changes in the grocery environment is the success of private labels (PLs). Since a large number of FMCG categories now already have at least one PL, retailers are increasingly adopting a multi-tiered PL strategy. In practice, this often means a switch from a single standard product offering to a three-tiered PL portfolio. This ranges from the typical cheap and low quality own labels (i.e., economy PLs) to somewhat less expensive PLs comparable in quality to the national brands (NBs) (i.e., standard PLs), to premium quality and high value added PLs (i.e., premium PLs) (Kumar and Steenkamp 2007). With this strategy retailers can satisfy the heterogeneous nature of consumers, and further create differentiation compared to their competitors (IRI 2016). For instance, Italian retailer Conad states that they grew in all channels primarily thanks to a multi-tier PL program, which they started a few years ago (Global Retail Mag 2013). Examples of retailers who launched a new economy or premium PL tier are international grocery chain 7-Eleven (Just Food 2015) in U.S. and Korean retailer Lotte (IGD 2014). In the same spirit, recently an increasing number of leading retailers have extended their PL tier offerings with new alternatives targeted to distinct consumer segments (IPLG Europe 2014), such as health and kids lines (e.g. Good For You at U.K. retailer Asda and Conad Kids at Italian retailer Conad). Likewise, U.S. retailer Kroger has expanded its organic and healthy (standard and premium) PL lines recently (Market Watch 2012). In the meantime,

[1] This chapter was written together with my supervisors Frank Verboven and Lien Lamey. It was published in Journal of Retailing and Consumer Services 36 (2017): 39-52.

industry observers increasingly state that economy PLs are facing big challenges. They are shrinking in volume sold since they fail to compete with discounters (IRI 2016). Moreover, they generate lower margins than standard PLs and most importantly they can cannibalize the current PL offerings that in the end leads category profit erosion (ter Braak et al. 2013; IPLG 2016). On the other hand, standard PL tier keeps its popularity and premium PLs is actually growing not only in size but also in value (IRI 2016). That brings us to evaluate what is the impact of this further proliferation within the tiers on consumer demand and retailer profits. In other words, whether new line introductions or delistings within different tiers help retailers. Together with this further proliferation in PL tier offerings, there is an ongoing discussion on how different PL tiers should be priced relative to each other and their NB competitors. The top retailers in U.K. (i.e. Tesco, Sainsbury's and Asda) have increased the price of economy PLs more than 40 per cent on average (Daily Mail 2012). Likewise, according to IRI, U.K. shopping basket data show that prices of standard PL items are slowly getting closer to NBs' prices (Just Food 2013; IRI 2016). Similarly, although industry observers advise the retailers to set their premium PLs price more than NB counterparts, there is still little known about how premium PLs should be priced (Millward Brown 2008 and World Trademark Review 2012).

Hence, this PL proliferation to new quality tiers (i.e. economy, standard and premium) and the further line proliferation within each tier pose challenges to a retailer's PL-NB portfolio management and price setting. Within a retailer, how do the different PL tiers/lines compete with each other and with the existing NBs in the assortment? And, how does this PL-NB competition influence consumer demand and retailer's profits? To answer these questions, we estimate a rich discrete choice demand model at the consumer level. The adopted approach allows us to derive demand and profit implications for different scenarios by calculating counterfactuals. More specifically, we derive the demand and profit effects under the following set of scenarios: (i) dropping or adding a line (kids, health or muesli)

within a PL tier and (ii) changing the PL tier prices. By predicting consumer purchase adjustments to these changes in a retailer's PL-NB portfolio, we can define which PL/NB tiers and lines win or lose in terms of demand. Moreover, we derive what happens to a retailer's profits, addressing the recent call for more PL studies on profit implications (see Sethuraman and Gielens 2014).

Insights on PL tiers in the academic literature are limited, as the majority of articles studying PLs do not make the distinction between different PL tiers. These studies regard PLs as one group (e.g. Lamey et al. 2012; Steenkamp and Geyskens 2014), or consider one specific tier (e.g. Pauwels and Srinivasan 2004). Nonetheless, ter Braak et al. (2014) study the category drivers of premium PL introduction. Among other things, they find that retailers are more likely to introduce premium PLs in categories with a more proliferated assortment in terms of standard PLs, still being aware of creating PL fatigue. Based on online experiments, Plameira and Thomas (2011) showed that consumers' quality perceptions of a premium PL increase in the presence of a value PL, whereas quality perceptions of a value PL are not affected by the presence of a premium PL alternative. In addition, Geyskens and colleagues (2010) show that, based on a brand-choice model with context effects, the introduction of an economy PL cannibalizes the incumbent standard PL but benefits the mainstream NBs. Similarly, an introduction of a premium PL cannibalizes the incumbent PLs (i.e. budget and standard) and sometimes benefits premium-quality NBs. Gielens (2012) studies the impact of PL and NB introductions on category sales and the share of the top-3 NBs and the three PL tiers (aggregated over brand variants). She finds, among other things, that new products introduced by standard PLs and premium PLs are sometimes able to boost category sales, to shrink NB rivals' shares, and to cannibalize other PL tiers (respectively, economy and premium, and only economy), whereas new products introduced under the economy PL flag only stimulates overall economy PL share. We contribute to this literature stream in multiple ways. To the best of our knowledge, we are the first to

study the demand implications of (i) further *line* proliferation within PL tiers (rather than PL *tier* introductions (see Geykens et al. 2010[2] & Palmeira and Thomas 2011) – or new *product* introductions within a PL tier (see Gielens 2012)) and (ii) different PL tier price settings. Finally, besides the demand implications of further proliferation and price decisions within the multi-tier PL strategy, we study the profit implications for the retailer.

In sum, the study aims to answer the following research questions: How do PL lines/ tiers and NBs compete within a retailer? What are the demand and profit implications of this competition for the retailer? The rest of the paper is organized as follows. In the next section, we provide a brief overview of the data, followed by a section that presents the empirical framework with more detail regarding the method of estimation. In section 2.4, we present the empirical results. In section 2.5, what-if scenarios are discussed in detail. Finally, we conclude with discussion, limitations and ideas for further research in section 2.6.

[2] Compared to Geyskens et al. (2010), we consider a lower level of aggregation in our demand model, where we only aggregate across different product sizes but not brand variants (i.e. different formulation, taste, …). This allows us to study the introduction and delisting of PL lines within each PL tier. Second, our model allows consumers' price sensitivity to differ not only between consumers but also between brand types (i.e. NB vs. PL), quality tiers (i.e. low, medium and high) and lines (i.e. kids, health), allowing us to better capture the implications of price changes. In addition, Geyksens et al. (2010) ignore the observations in which no purchase occurs in the category at the retailer, which is problematic due to informative-missingness (Chib, Seetharaman and Strijnev 2004). As such, our model is extended with an outside good option that captures the consumers' decision to purchase in the category at another retailer, and thus allows consumers to switch to offerings of competing retailers in response to an assortment or price changes at the focal retailer (Chintagunta, Bonfrer and Song 2002), which again results in more realistic substitution patterns. Finally, whereas Geyskens et al. (2010) study demand shifts due to an introduction of an economy and premium PL tier over time (going from 1993 to 2006), our study studies consumer demand in a setting where all three PL tiers and its lines are already well-established in the market (i.e. 2008-2009).

2.2 Data

Research Context

To study the competition between PLs and NBs, we obtained U.K. household panel data from Kantar Worldpanel through AiMark. This panel data consists of purchase records of a representative set of 2,353 U.K. households that shop in the ready to eat cereal (RTE) cereal category for the period between 1 January, 2008 and 31 December, 2009.

The U.K. has one of the strongest PL presences in Europe and is considered as the most advanced and sophisticated PL country globally with a (volume) market share of over 45% (IRI 2015; PLMA 2016). One of the most distinctive features of the U.K. grocery market is that PLs present in virtually every product category for several decades (Burt 2000). Hence, in our estimation window, the U.K. Market is already a mature PL market where all the brand introductions were made several years ago and consumers are well aware of the three PL tiers and theirs line extensions. According to industry observers, many countries are headed towards the U.K. model (Cotterill 1997), which makes our time window representative for other countries moving slower in their PL lines development. In our observation period, economy, standard and premium PLs cover respectively 2.96%, 23.64% and 0.27% of the RTE cereal volume sales across all retailers. The outstanding success of PLs in the U.K. can largely be attributed to the fact that 74% of the retail grocery market is held by the top four retailers (The Guardian 2013). Indeed, the empirical literature and the industry findings show that the level of concentration in the retail market is directly related to the market share of PLs in total retail sales (Bozhinova 2014; Tarziján 2003; Nielsen 2014). High concentration in grocery retailing is the key factor behind the high market share of PLs in UK (PWC 2011). Hence the current PL market structure, where these multi-tiered PL offerings are pioneered (Kumar and Steenkamp 2007) makes U.K. an interesting place to study.

In our analysis, we focus on two of the three largest retailers in the U.K. grocery market, namely Asda and Sainsbury's. *Asda* (*Sainsbury's)* is the second (third) largest retailer in the U.K. grocery market with 525 (597) stores and a market share of 17.1 (16.4%) in 2016 (Asda Supplier 2016; J Sainsbury plc 2016). Both retailers offer a popular PL assortment fitting into the 3-tier ranging strategy: 'Good' (i.e. (Asda's) Smart Price, Sainsbury's Basics), 'Better' (i.e. (Asda's) Chosen by You, Sainsbury's) and 'Best' (i.e. (Asda's) Extra Special, (Sainsbury's) Taste the Difference), accounting for 45.8% at Asda and 50.8% at Sainsbury's of total volume sales (The Grocer 2014).

To answer our research questions, we obtained data for the *RTE cereal category*. The RTE cereal category is a large, mature category for both PLS and NBs, where more than 40% of U.K. consumers regularly buy PLs (YouGov 2013). The RTE cereal category consists of a large number of brand variants (e.g. honey, chocolate, blueberry) grouped within multiple lines[3] (e.g. kids, health, muesli) of several PLs and NBs in the different quality tiers, making it a perfect category to study the competition between PLs and NBs across tiers, lines and brand variants. Importantly, no re-brandings of PLs and NBs, or major PL or NB entries or exits occurred in our two-year observation period.

Level of Aggregation

The majority of marketing studies aggregate SKU's at the brand level (see for instance Geyskens et al. 2010, Horsky et al. 2012 and Gordon et al. 2013). In our research setting, where we focus on brand variants to derive competition, this would lead to an aggregation bias. In fact, SKU's in the RTE cereal category varies in terms of size, flavour and main ingredient (i.e. corn, barley, oat). But, even more importantly, each SKU (irrespective of size) of the same brand considerably varies in terms of

[3] Some brand variants are classified to more than one line. In Sainsbury's, 7% of the brand variants are classified as both muesli and healthy cereal. In Asda, we don't see such overlapping.

its pricing. Therefore, we only aggregate SKUs across sizes and not across brand variants, and call it "*brand variant*".[4]

In line with Empen et al. (2011), we select for each retailer all brand variants with a volume share above 0.5%.[5] This results in 63 (57) selected brand variants at Asda (Sainsbury's) which belong to four NB mother brands, namely Kellogg's, Nestle and Weetabix, Quaker and all PL tiers, accounting for 79 (82%) of the RTE cereal category volume sales at Asda (Sainsbury's).

We adopt the expert-based classification used by Geyskens et al. (2010) to group each brand variant into a quality tier, i.e. low, medium or high. Taking into account the brand type (i.e. NB vs. PL), this results in five groups: *mainstream NB* (medium quality, i.e. Nestlé & Weetabix), *premium NB* (high quality; i.e. Kellogg's), *economy PL* (low quality; i.e. Sainsbury's Basics), *standard PL* (medium quality) and *premium PL* (high quality). Table 2-1 gives an overview of the average price paid, market share and level of proliferation for each group and each retailer. Overall, the economy PLs are standing at the bottom-of-the-market as a lowest priced option, followed by the standard PLs and subsequently premium PLs are positioned close to NBs, which is in line with Kumar and Steenkamp (2007). The number of brand variants and SKUs are comparable for standard PL, mainstream NB and premium NBs, while it is considerably lower for economy and premium PLs. At both retailers PLs have a combined (volume) market share above 40% (i.e. 47.7% at Asda and 44% at Sainsbury's). Despite these overall similarities, the chosen PL price strategy clearly differs between both retailers. The price gaps between the different PL tiers at Asda are much smaller than at

[4] For instance, under the mother brand flag Kellogg's, Kellogg's Special K brand offers the following brand variants among others: Kellogg's Special K (regular), Kellogg's Special K Red Fruit, Kellogg's Special K Yogurt, where the different package sizes (e.g. Kellogg's Special K Red Fruit 500g and 300g) are aggregated within a brand variant.

[5] For the premium PL tier, we relaxed this rule and include all PL brands (and its corresponding brand variants) where the combined market share of all brand variants is above 0.5%, in order to include sufficient PL premium alternatives in our analysis.

Sainsbury's, whereas the Sainsbury's PL tier prices cover a much broader spectrum going from 0.87 for their economy PLs to 2.87 for the premium PLs compared to 1.00 and 2.41, respectively, at Asda. In addition, the Asda assortment is more proliferated in terms of the number of SKUs. The only exception is the premium tier, where Asda only offers 3 cereal alternatives compared to 27 at Sainsbury's.

Table 2-1 Summary statistics

	Mean Price (price per kilo)		**Market Share (volume)**		**# Brand Variants**		**# SKUs**	
	Sainsbury's	**Asda**	**Sainsbury's**	**Asda**	**Sainsbury's**	**Asda**	**Sainsbury's**	**Asda**
Economy PL	0.87	1	4.23%	7.00%	4	8	20	46
Standard PL	1.98	2.06	34.02%	40.40%	15	23	145	283
Premium PL	2.87	2.41	6.15%	0.30%	6	2	27	3
Mainstream NB	3.54	3.63	27.48%	21.60%	20	15	146	189
Premium NB	3.7	3.45	28.12%	30.60%	12	12	144	225

We further classify each brand variant in *lines*. More specifically, we distinguish brand variants into kids, health, muesli and regular RTE cereal lines. Brand variants are classified as a "*kids*" line alternative if the product package carries a picture of a cartoon or another kids friendly image (Ulger, 2008). Cereals based on raw rolled oats and other ingredients including grains, fresh or dried fruits, seeds and nuts, are classified as "*muesli*" cereals. To determine whether the alternative is *health*y or not, we check whether brand variants are advertised as a healthy cereal with a specific name/range (e.g. *Kellogg's Red Berry Special K*, *Sainsbury's Be Good To Yourself* range) and/or whether they are emphasizing the health on its packaging (e.g. '*good source of fibre'* or '*made with wholegrain'*).

Household Selection

In line with Seetharaman (2004) and Geyskens et al. (2010), we exclude households that did not purchase one of the selected brand variants at least four times per year, on average, as well as households for which the selected brand variants did not represent minimum 70% of their yearly category purchases at the retailer.

2.3 Methodology

Demand Model

To answer our research questions, we apply a rich random coefficients logit model for the RTE category for each retailer. The indirect latent utility of household i from buying brand variant j during weekly shopping trip t at the retailer is given by[6]:

$$U_{ijt} = \gamma_{ij} + \beta_i X_{jt} + \alpha_i p_{jt} + \theta_i I_{ijt} + \xi_{jt} + \epsilon_{ijt} \quad (1)$$

where γ_{ij} denotes a household *i's* valuation for brand variant j (relative to the base option which is outside good). The assortment variable X_{jt} [7] quantifies the number of SKU's available for brand variant j, and β_i captures a household *i*'s valuation with respect to the assortment variable. Furthermore, p_{jt} is average price paid across all households for brand variant j at week *t*, converted

[6] For some households in certain weeks, multiple shopping trips within a week are observed, which is the case for 40.75% of the observed shopping trips. In this case we only selected the first shopping trip of the specific week for analysis. However, the same substantive findings are obtained (i) if we allow for daily instead of weekly shopping trips, or (ii) if these multiple weekly observations for a household are retained by using different household id's for each additional shopping trip with a week but with identical household characteristics. In addition, some households buy multiple brand variants at the same weekly shopping trip, which is the case for 22,38% of the observed shopping trips. For the sake of simplicity, we only included the first brand variant registered in the panel dataset for that household at the specific at Sainsbury's. However, similar findings are obtained if we randomly select a brand variant out of all brand variants bought by a household at a specific shopping trip.

[7] The competitive effects such as the assortment depth of other PL tiers and NB tiers are not directly entering the utility in Equation (1). However, they affect the choice probabilities.

in real terms using the yearly U.K. consumer price index obtained from the Office for National Statistics in the U.K., and α_i is a household-specific valuation of price. I_{ijt} denotes a dynamic loyalty variable, suggested by Guadagni and Little (2008) and specified as:

$$I_{ijt} = \lambda I_{ijt-1} + (1-\lambda) LastPurchase_{ijt} \quad (2)$$

where $LastPurchase_{ijt}$ is a dummy variable equal to 1 when brand variant j was last purchased at the retailer, and 0 otherwise, λ is a smoothing constant between 0 and 1[8] (see Melis et al. 2015 for a similar practice). Hence, the parameter θ_i captures a household's "loyalty" or "switching cost" of moving from one brand variant to another (Gordon et al. 2013; Guadagni and Little 2008). Unobserved brand variant characteristics, ξ_{jt}, may include brand variant image, quality and assigned shelf space. Finally, ϵ_{ijt} is a household *i* specific valuation for brand variant j in week *t* i.e. the "logit error term". It is identically and independently distributed across brand variants according to the Type I extreme value distribution.

In order for our model to yield plausible and realistic substitution patterns among the brand variants offered by the focal retailer, it is necessary to include an "outside good" option (Nevo 2001). In our research setting, the outside good option $(j = 0)$ for the brand-variant choice decision is to purchase cereal from any other grocery retailer in the U.K. market. Without incorporating the existence of an outside good option, a simultaneous increase in the price of all brand variants offered by our focal retailer would result in no change in total consumption at the retailer. This would ignore the fact that consumers are able to buy their cereals at competing retailers.

We consider a specification that allows for both *observed and unobserved household heterogeneity* regarding the valuations of alternatives. The alternative *j* evaluations, γ_{ij}, and the price

[8] In line with prior research (Spotts 2014; Gupta 1988 and Kalwani et al. 1990), the smoothing constant is set equal to 0.7. Still, the same substantive findings are obtained for alternative smoothing constants (0.6, 0.75 and 0.87).

sensitivity, α_i, may depend on both observed household characteristics and unobserved heterogeneity. Based prior literature and data availability, we include the following observed household characteristics: *Number of Children*$_i$, *Social Class*$_i$ (i.e. lower versus middle versus upper), *Average Buying Frequency*$_i$ and *Share of Wallet*$_i$. *Average Buying Frequency*$_i$ denotes how many times on average a household shops for cereal at Sainsbury's during a 4-week time window (Bodapati and Gupta 2005). *Share of Wallet*$_i$ represents the household's average spending on cereal in the focal retailer relative to all other U.K. retailers (Ailawadi et al. 2008; Gordon et al. 2013). Unobserved heterogeneity is incorporated through a random coefficient approach.

With regard to the valuations for the different alternatives, we specify two terms: one for the outside good (3) and one for the brand variants (4):

$$\gamma_{i0} = \gamma_0^0 + \gamma_0^\sigma v_i^r \qquad v_i \sim N(0,1) \tag{3}$$

$$\gamma_{ij} = \gamma_j^0 + \sum_h \sum_p \gamma^{hp} HHchar_{hi} * PGdummy_p \tag{4}$$

where γ_j^0 captures the means of the distributions of heterogeneity across households with respect to intrinsic brand variant j preferences. In order to capture the observed heterogeneity for the valuation of product group dummy variables, we interact product group dummies ($PGdummy_p$) with household characteristics $HHchar_{hi}$, where p is an index for the product groups and hi is an index for observed household characteristics. [9], [10]

With regard to the valuation of price, we specify the price coefficient as:

$$\alpha_i = \alpha^0 + \sum_h \alpha^h HHchar_{hi} + \alpha^\sigma v_i^r \qquad v_i \sim N(0,1) \tag{5}$$

[9] The product group dummies refers to both (i) line dummies (i.e. kids, muesli and health) and (ii) group dummies (i.e. brand type vs. quality tiers) (i.e. economy PL, standard PL, premium PL, mainstream NB and premium NB).
[10] The mean valuation of the product group dummies was dropped from the model due to multicollinearity problems as individual brand variant dummies are also included in the model.

where α^0 is the mean responsiveness to the price, common across households. To account for observed heterogeneity, we interact price with the above mentioned observed household characteristics $HHchar_{hi}$. To account for unobserved heterogeneity, we use a random coefficient specification for price (Chintagunta et al. 2002). Here, α^σ is the standard deviation around the mean valuation of price and v_i is a random draw from the standard normal distribution, capturing unobserved household heterogeneity regarding price[11].

Estimation

Based on the model assumptions, the probability that household i with unobservable characteristic vector v_i chooses the brand variant j that maximizes utility among all the available alternatives is given by:

$$Pr_{ij}(v_i) = \frac{\exp(\gamma_{ij} + \beta_i X_{jt} + \alpha_i p_{jt} + \theta_i I_{ijt} + \xi_{jt})}{1 + \sum_{k=1}^{J} \exp(\gamma_{ik} + \beta_i X_{kt} + \alpha_i p_{kt} + \theta_i I_{ikt} + \xi_{jt})} \quad (6)$$

These choice probabilities can be integrated over the unobserved and normally distributed term v_i, to obtain average choice probabilities for each household. We then estimate the model with simulated maximum likelihood as in Chintagunta and Dube (2005) and Train (2003). To approximate the integral in the choice probability, we take 100 draws for v_i from the standard normal distribution (see Appendix for the details).

[11] In the special case where $\alpha^\sigma = 0$, there is no unobserved heterogeneity and we would obtain the conditional logit model.

Counterfactuals

To conduct our counterfactuals, we compute diversion ratios to compute how closely brand variants and product groups compete with each other; and its corresponding profit implications.

Diversion ratio. A diversion ratio quantifies the proportion of demand captured by the different alternatives in the market when price of one of the alternatives is changed (see Kelchtermans and Verboven (2007) and Conlon and Mortimer (2013) for an in-depth discussion). A practical advantage of the diversion ratio is that it is a unit free measure, which captures the relative degree of competition between products very well. As such, it gives similar magnitudes when one considers substitution responses to small or larger price changes, or to an entire product elimination. We consider here the effect of an elimination of all brand variants in group δ_1 (i.e. dropping a tier) from the retailer's assortment, which is the special case where the prices in the group become infinitely large. In this case, $DR_{\delta_1\delta_2}$ measures the fraction of demand lost from the eliminated group δ_1 that flows back to the group δ_2.

$$DR_{\delta_1\delta_2} = \frac{\sum_i \sum_{k\in\delta_2}(s_{ik}(\boldsymbol{p^1}) - s_{ik}(\boldsymbol{p^0}))}{\sum_i \sum_{j\in\delta_1} s_{ij}(\boldsymbol{p^0})} \quad (7)$$

The initial price vector $\boldsymbol{p^0}$ consists of the current prices of all brand variants, and the new price vector $\boldsymbol{p^1}$ sets the price to infinity for the eliminated brands *j* in the group δ_1. For example, to capture the demand implications of a PL tier line *delisting*, the prices of all brand variants within this PL tier line are replaced with a very high price (such that its demand $s_j(\boldsymbol{p^1})$ becomes zero where $s_j(\boldsymbol{p^1}) = \sum_i s_{ij}(\boldsymbol{p^1})$) while keeping the prices of the other brand variants at the same level in the new price vector. The diversion ratios measure the percentage of PL tier line demand that goes to each brand variant. Similarly, to capture the demand implications of an *introduction* of a PL tier line, we generate a hypothetical price level, assortment level and loyalty value for all new brand variants within this PL

tier line[12]. Note that the diversion ratio formula (7) is a special case of a finite price increase for the products in group δ_1.[13] We finally point out that the concept of the diversion ratio is closely related to own- and cross-price elasticities[14] (see e.g. Werden (1998)). In both cases, the prices of rival products are kept fixed; in profit counterfactuals, one can allow prices of rivals to respond.

Profit. We also consider the profit incentives for eliminating (i) a group of brand variants, and (ii) changing the price gap between PL tiers and NB tiers. In order to calculate the net effects on category profit, we supplement our data with the external margin information[15] $m_j^0 = (p_j^0 - c_j)/p_j^0$ that allows us to derive wholesale price c_j. For PL tiers, we obtained average margin data per brand type & tier for our focal category (i.e. RTE cereal) from AiMark (for a comparable retailer in the Dutch market) together with the accompanying standard deviation. Retailers' percentage profit margins m_j^0 are 21.6% for economy PLs, 34.5% for standard PLs and 28.3% for premium PLs on average. Similarly, for NBs, it is 20%. Suppose that there is a price increase of all brands *j* in group δ_1 (either a finite price increase, or an infinite increase in case the product is eliminated). The change in profits from such a price increase or delisting of the brand variants in group δ_1 is as follows:

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[12] For instance, to construct the prices of newly introduced economy PL kids alternatives, first we calculate the ratio between standard PL regular and standard PL kids alternatives, Then, multiply this ratio with economy PL regular alternatives to construct economy PL kids prices.

[13] In the more general case of a finite price change of the alternatives in a group, the relevant formula for the diversion ratio is: $DR_{\delta_1\delta_2} = -\frac{\sum_i \sum_{k\in\delta_2}(s_{ik}(\boldsymbol{p^1}) - s_{ik}(\boldsymbol{p^0}))}{\sum_i \sum_{j\in\delta_1}(s_{ij}(\boldsymbol{p^1}) - s_{ij}(\boldsymbol{p^0}))}$. If we eliminate the entire group (by setting the $p_j = \infty$), then $s_j(\boldsymbol{p^1}) = \sum_i s_{ij}(\boldsymbol{p^1}) = 0$, so that we obtain (7).

[14] If we denote the own-price elasticity of product A by ε_A and the cross-price elasticity of product B's demand with respect to A's price by ε_{BA}), then the diversion ratio becomes the following:

$$\Delta q_B / \Delta q_A = (\varepsilon_{BA} q_B)/(-\varepsilon_A q_A)$$

This can be interpreted as the ratio of the cross-price over the own-price elasticity, multiplied by the demand ratio of A and B.

[15] Following the example of Allenby and Rossi (1991), the retailer who seeks to apply this method to solve his pricing problem will have access to accurate cost data.

$$\Delta\pi = \sum_{j\epsilon\delta_1} \underbrace{\left(\pi_j(\boldsymbol{p^1}) - \pi_j(\boldsymbol{p^0})\right)}_{\text{Change in profit affected products}} + \sum_{j'\epsilon\delta_1} \underbrace{\left(\pi_{j'}(\boldsymbol{p^1}) - \pi_{j'}(\boldsymbol{p^0})\right)}_{\text{Change in profit remaining products}} \tag{8}$$

$$= \sum_{j\in\delta_1} \left[(p_j^1 - c_j)s_j(\boldsymbol{p^1}) - (p_j^0 - c_j)s_j(p^0)\right] + \sum_{j'\epsilon\delta_1} \left[\left(p_{j'}^1 - c_{j'}\right)s_{j'}(\boldsymbol{p^1}) - (p_{j'}^0 - c_{j'})s_{j'}(\boldsymbol{p^0})\right] \tag{9}$$

$$\text{where} \quad s_j(p) = \textstyle\sum_i s_{ij}(p) \text{ and } s_{j'}(p) = \sum_i s_{ij'}(p) \tag{10}$$

This can be written as:

$$\Delta\pi = \sum_{j\epsilon\delta_1} \Big[\underbrace{(p_j^1 - p_j^0)s_j(\boldsymbol{p^1})}_{\text{direct price effect}} + \underbrace{m_j^0 p_j^0 \left(s_j(\boldsymbol{p^1}) - s_j(\boldsymbol{p^0})\right)}_{\text{reduced sales effect for affected alternatives}}\Big] + \sum_{j'\epsilon\delta_1} \underbrace{m_{j'}^0 p_{j'}^0 \left(s_{j'}(\boldsymbol{p^1}) - s_{j'}(\boldsymbol{p^0})\right)}_{\text{increased sales effects for remaining alternatives}} \tag{11}$$

$$\text{where } m_j^0 = \frac{p_j^0 - c_j}{p_j^0} \text{ and } m_{j'}^0 = \frac{p_{j'}^0 - c_{j'}}{p_{j'}^0} \tag{12}$$

According to equation 11, the profit effect of a price increase or an entire delisting consists of three terms. The first term captures the direct profit effect from the price increase on the category profit. This term will be zero under an entire elimination of the group (since then $\boldsymbol{p^1}$ is sufficiently large so that $s_j(\boldsymbol{p^1}) = 0$). The second term captures the negative effect on category profits from the reduced sales of the products in group δ_1. Finally, the last term captures the substitution effect, i.e. the positive effect on profits from the increased sales of the other alternatives.

The above discussion considered the profit impact of a price increase or delisting, holding the rival prices fixed. In practice, one can also consider the profit impact when the rivals respond. As a robustness analysis, we consider counterfactuals where rivals respond by half of the initiated price increase. This avoids a full equilibrium analysis, which would in any case have to rely on various assumptions such as the complicated manufacturer-retailer relationship.

2.4 Empirical Results

Parameter Estimates

The parameter estimates of our two demand models are presented in Table 2-7 and Table 2-8. The negative *price* coefficient (Asda: -0.982; p<.01; Sainsbury's: -1.081; p<.01)[16], indicates that households are overall price sensitive. Still, there is sufficient heterogeneity both observed, as illustrated by the significant interactions with the household characteristics, and unobserved (Asda: SD=0.614; p<.01; Sainsbury's: SD=0.534; p<.01), as has also been reported in previous literature (Meza and Sudhir 2010). Also, consumer heterogeneity regarding the valuation of the inside goods relative to the *outside good* is observed (Asda: SD=3.024; p<.01; Sainsbury's: SD=2.888; p<.01). On average, the significant random coefficient for the outside good dummy variable indicates that substitution between inside goods (current retailer's offerings) is stronger than substitution towards

[16]Although we include a full set of brand variant fixed effects, price (p_{jt}) might be correlated with unobserved changes in brand variant characteristics. To assess this possible endogeneity, we adopt the control function approach (Petrin and Train 2010). We use two sets of instruments: (i) weekly commodity price indexes for the main ingredients of RTE cereal, namely wheat, barley, oat and sugar, collected by the Department for Environment, Food and Rural Affairs U.K. interacted with brand variant dummies, as each brand variant has a different composition of main ingredients and (ii) the price of the same brand variant at the focal retailer in the previous week (p_{jt-1}) (see Villas-Boas and Winer 1999 for a conceptually similar practice). All auxiliary regressions showed acceptable levels for R^2 (>95%). For both retailers, we find that the parameter estimates, and in particular the price coefficient, remain very similar after accounting for the correction term for both sets of instruments. This suggests that our specification already accounts well for unobserved brand variant characteristics and the role of time-varying unobservables is limited.

the outside good (other retailers' offerings) (Asda: 7.479; p<.01; Sainsbury's: 7.513; p<.01). Furthermore, the more SKUs a retailer offers within a brand variant, the more likely households are to choose the brand variant (Asda: 0.062; p<.01; Sainsbury's: 0.085; p<.01) (see Tan and Cadeaux 2011 for similar insights). Similarly, the significant positive brand-variant loyalty coefficient (Asda: 11.650; p<.01; Sainsbury's: 11.930; p<.01) reveals that due to state dependence, a brand variant has a higher probability of being purchased if a brand variant has been bought on previous purchase occasions, supporting prior work (Pauwels et al. 2002 and Geyskens et al. 2010).

With regard to the *brand type*quality tier dummies* (relative to outside good option) interacted with the household characteristics, substantial heterogeneity across households is observed. For instance, households that belong to a low social class (Asda: 0.538; p<.01; Sainsbury's: 0.973; p<.01) and households that spend a larger portion of their cereal budget at the retailer are more likely to purchase economy PL options (Asda: 4.333; p<.01; Sainsbury's: 3.015; p<.01). Standard PLs are less appealing for households with children (Asda: -0.362; p<.01; Sainsbury's: -0.268; p<.01), and households' probability of choosing standard PLs increases if their spending portion of their budget at the retailer increases (Asda: 4.526; p<.01; Sainsbury's: 3.652; p<.01). Although Geyskens et al. (2010) find that the premium PL appeal is not related to household socio-demographics, we find that premium PLs are less appreciated by households with children (Asda: -0.627; p<.01; Sainsbury's: -0.466; p<.01) and are bought by more loyal households (Asda: 3.872; p<0.01; Sainsbury's: 3.445; p<0.01).

With regard to the *line dummies* (i.e. kids, muesli and health) interacted with household characteristics, again significant observed heterogeneity is observed. Among others, the number of children has a negative effect on the probability of choosing health (Asda: -0.206; p<.01; Sainsbury's: -0.220; p<.01 and muesli lines (Asda: -0.157; p<.01; Sainsbury's: -0.137; p<.01), but the opposite

effect for kids alternatives (Asda: 0.278; p<.01; Sainsbury's: 0.327; p<.01) which is in line with Nevo (2001). Furthermore, households that belong to low class tend to be less likely to buy healthy alternatives (Asda: -0.127; p<.01; Sainsbury's: -0.128; p<.01). In contrast, low class households are more likely to choose kids brand variants (Asda: 0.340; p<.01; Sainsbury's: 0.129; p<.05). Similarly, household who are more frequently buying cereals at the specific retailer tend to be less likely to purchase healthy (Asda: -0.027; p<.01; Sainsbury's: -0.015; p<.05) cereals. Also, the probability of choosing healthy cereals decreases as households' share of wallet increases for Sainsbury's -0.177; p<.01). However, we find that healthy alternatives in Asda are more appreciated if the households' become more loyal to Asda (Asda: 0.274; p<.01).

In sum, these findings indicate the importance of accounting for both observed and unobserved consumer heterogeneity, in particular regarding the valuation of the price and importance of including both line and brand type*tier dummies. Accounting for this type of heterogeneity results in more flexible substitution patterns and a first indication that substitution is also driven by quality tier, brand types and attributes. We will explore this in much more detail in our counterfactuals in the next subsection.

2.5 What-if scenarios

Elimination/introduction of a line within a PL Tier

Here, we explore the demand and profit implications of adding or dropping (i) a kids line, (ii) a health line; and (iii) a muesli line for each PL tier. To disentangle who wins or loses, we compare the inside diversion ratios derived from our rich model with observed and unobserved household heterogeneity with the "fair share" derived from a simplified model without any household heterogeneity

(benchmark setting) (see Table 2-9 in Appendix). The fair share or benchmark share therefore captures the expected changes in market share if the demand of the removed (introduced) PL line variant shifts proportionally to (from) each incumbent. A diversion ratio relative higher (lower) than the fair share indicates that the tier/line/brand variant wins relatively more (less) demand[17].

Kids line. First, when the *kids* PL line from the standard PL tier is eliminated (see Table 2-9 in Appendix), its share is mainly absorbed by the outside good (Asda: 24.30%; Sainsbury's: 26.2%), followed closely by standard PL non-kids (Asda: 18.33; Sainsbury's: 18.70%) and mainstream NB non-kids (Asda: 18.8%; Sainsbury's: 21.8%) options. However, a comparison with the benchmark setting shows that all remaining kids options benefit from this elimination. For instance, Table 2-2 shows that mainstream NB and premium NB kids options gain more than the fair share. Still, non-kid options within the same quality tier at Sainsbury's (i.e. standard PL tier and mainstream NB) and the same brand type and quality tier at Asda (i.e. standard PL tier) gain more than their fair share. These demand switches result in a profit decrease for the retailer of 1.9% in Sainsbury's and even 11.4% in Asda (who offers a broader kids assortment under the standard PL tier).

We are unable to quantify the impact of eliminating the kids PL line in the other two tiers (economy and premium PL), since both options are not offered by Asda and Sainsbury's during our observation period. As such, we consider the effect of hypothetically including the kids PL line in these tiers. For the economy PL tier, benchmark setting comparisons reveal that the introduction of economy kids alternative in Sainsbury's strongly hurts retailer's incumbent kids offerings (all with a higher margin), irrespective of the brand-quality type, resulting in a profit decrease -0.05%. However, in Asda, this introduction mainly hurts standard PL kids options and results in a profit decrease -

[17] For the clarification, we only report the detailed kids line results for one retailer (Asda) in the Appendix. Detailed results tables for the health and muesli lines are available on request.

0.23%. Moreover, the introduction of the kids line in the premium PL tier leads to an overall profit decrease -0.07% in Sainsbury's but profit increase 0.04% in Asda. In Sainsbury's, introduction of premium kids line hurts standard PLs, but also high margin mainstream, premium NB kids and mainstream NB regular options because of their greater drawing power (Sethuraman 1995). However, in Asda, this introduction only hurts standard PL regular options.

Table 2-2: Overview of kids delisting/introduction

Economy PL		**Standard PL**		**Premium PL**		**Mainstream NB**		**Premium NB**		**Profit**
Kids	**Regular**	**Kids**	**Regular**	**Kids**	**Regular**	**Kids**	**Regular**	**Kids**	**Regular**	
Sainsbury's										
Introduce	(=)	**(- -)**	(=)	N.A.	(=)	**(-)**	(=)	**(-)**	(=)	-0.05%
N.A.	(=)	**Drop**	(=)	N.A.	(=)	**(++)**	**(++)**	**(++)**	(=)	-1.9%
N.A.	(=)	**(- -)**	(=)	**Introduce**	(=)	**(- -)**	**(- -)**	**(- -)**	(=)	-0.07%
Asda										
Introduce	(=)	**(- -)**	**(- -)**	N.A.	(=)	(=)	(=)	(=)	(=)	-0.23%
N.A.	(=)	**Drop**	**(++)**	N.A.	(=)	**(++)**	(=)	**(++)**	(=)	-11.4%
N.A.	**(=)**	**(=)**	**(- -)**	**Introduce**	**(=)**	**(=)**	**(=)**	**(=)**	**(=)**	+0.04%

Notes: N.A. = not available at the retailer; (=): (diversion ratio – fair share) <0.5; (+) : 0.5 < (diversion ratio – fair share) <1; (++) = (diversion ratio – fair share) >1 ; + and - : net profit respectively increases or decreases due to the elimination/introduction.

Healthy line. When standard PL *healthy* brand variants are eliminated at Sainsbury's, the lost share is mainly captured the outside good (36.39%), followed by brands from the standard non-health (16.20%), premium NB non-health (14.06%) and mainstream NB non-health categories (11.37%). Similar patterns are observed for Asda, except that the outside good is the least attractive option (15.22% compared to 36.39%). This implies that the healthy standard PL at Sainsbury's is able to attract considerably more cereal sales from competing retailers. Within the retailer, a comparison with the benchmark setting shows that the standard PL healthy line cannibalizes its own regular options and, in the case of Sainsbury's (Asda) steal share from the mainstream NB healthy (premium NB regular) options (see Table 2-3). As a result, the elimination of a healthy standard PLs leads to a category profit decrease of 2.60% in Sainsbury's and 0.09% in Asda.

When the retailer's premium PL healthy line is eliminated (Table 2-3), we see that the standard non-healthy options and mainstream NB healthy options again gain more than in the proportional benchmark setting in Sainsbury's and only standard regular options gain more than fair shares in Asda. Overall, adopting a healthy line under premium PL tier leads to a category profit increase of 2.84% in Sainsbury's and 0.04% in Asda.

Table 2-3 Overview of health delisting/introduction

Economy PL		Standard PL		Premium PL		Mainstream NB		Premium NB		Profit
Health	Regular	Health	Regular	Health	Regular	Health	Regular	Health	Regular	
Sainsbury's										
Introduce	(=)	(=)	**(- -)**	(=)	(=)	(=)	**(-)**	(=)	(=)	-0.04%
N.A.	(=)	**Drop**	**(++)**	(=)	(=)	**(+)**	(=)	(=)	(=)	-2.60%
N.A.	(=)	(=)	**(++)**	**Drop**	(=)	**(++)**	(=)	(=)	(=)	-2.84%
Asda										
Introduce	(=)	(=)	**(- -)**	(=)	(=)	(=)	(=)	(=)	(=)	-0.07%
N.A.	(=)	**Drop**	**(++)**	(=)	(=)	(=)	(=)	(=)	**(+)**	-0.09%
N.A.	(=)	(=)	**(++)**	**Drop**	(=)	(=)	(=)	(=)	(=)	-0.04%

Notes: N.A. = not available at the retailer; (=): (diversion ratio – fair share) <0.5; (+) : 0.5 < (diversion ratio – fair share) <1; (++) = (diversion ratio – fair share) >1 ; + and - : net profit respectively increases or decreases due to the elimination/introduction.

If we hypothetically introduce an economy health PL alternative, this introduction mainly hurts standard PL regular options in both retailers, and mainstream NB regular options in a small extent in Sainsbury's. This results in a category profit decrease of 0.04%. and 0.07% in Sainsbury's and Asda.

Muesli line. When the *muesli* line is dropped from the economy PL tier, a comparison of diversion ratios with benchmark setting shows that consumers substitute to closest tier's muesli alternatives which is standard PL muesli line. We also find that non-muesli standard PL alternatives gain more than their proportional or fair share in Sainsbury's (see Table 2-4). This can be expected given their strong low-price focus. Although the muesli line under the economy PL tier is able to

attract considerable consumer demand from competing retailers, offering muesli line under economy PL still leads to a category profit decrease of 0.5% in both retailers.

Table 2-4 Overview of muesli delisting/introduction

Economy PL		Standard PL		Premium PL		Mainstream NB		Premium NB		Profit
Muesli	Regular	Muesli	Regular	Muesli	Regular	Muesli	Regular	Muesli	Regular	
Sainsbury's										
Drop	(=)	**(+)**	**(+)**	(=)	(=)	(=)	(=)	N.A.	(=)	+0.5%
(=)	(=)	**Drop**	**(+)**	**(++)**	(=)	**(+)**	(=)	N.A.	(=)	-0.3%
(=)	(=)	**(+)**	**(+)**	**Drop**	(=)	**(+)**	(=)	N.A.	(=)	-0.4%
Asda										
Drop	(=)	**(++)**	(=)	(=)	(=)	(=)	(=)	N.A.	(=)	+0.5%
(=)	(=)	**Drop**	**(+)**	(=)	(=)	(=)	(=)	N.A.	**(+)**	+0.08%
(=)	(=)	**(+)**	(=)	**Drop**	(=)	(=)	(=)	N.A.	(=)	-0.02%

Notes: N.A. = not available at the retailer; (=): (diversion ratio – fair share) <0.5; (+) : 0.5 < (diversion ratio – fair share) <1; (++) = (diversion ratio – fair share) >1 ; + and - : net profit respectively increases or decreases due to the elimination/introduction.

Similarly, when standard PL tier muesli alternatives are delisted from the assortment (see Table 2-4), benchmark comparisons reveal that consumers mainly switch to the closest tiers' with muesli alternatives, which are premium PL and mainstream NB in Sainsbury's. However, some consumers prefer to stay in the standard PL tier and switch to standard regular options both in Asda and Sainsbury's. Overall, adopting a muesli line under a standard PL tier leads to a category profit increase of 0.3% in Sainsbury's and profit decrease 0.08% in Asda.

Moreover, when the muesli line is dropped from the premium PL tier (see Table 2-4), consumers again mainly switch to closest tiers muesli alternatives, which are standard PL and mainstream NB. However, standard PL non-muesli options also gain some share in Sainsbury's. In total, irrespective of the cannibalization with the standard PL tier, the higher margin premium PL labels results again in a profit increase of 0.02% in Asda and 0.4% in Sainsbury's.

We can summarize the line extension based findings as follows: When a kids line is eliminated/introduced in any PL tier, consumer show overall a more or less loyal pattern to the attribute itself and switch to available incumbent kids options irrespective of the brand type (PL vs. NB). In contrast, for the health attribute, the dominant behaviour is to switch to regular options of standard PL since it is the closest tier in brand-quality type dimension or mainstream NB healthy options. And lastly, for the muesli attribute, the dominant behaviour is to switch to standard PLs regardless of the presence of the attribute. Only at Sainsbury's, where between PL tier is less strong, consumers also switch to other available incumbent muesli options. In addition to this, we see that line extensions can be a win-win outcome for retailers since they lead higher profits despite cannibalization of incumbent sales. This mitigates the concern of Quelch and Kenny (1994) about cannibalization being a serious problem with line extensions (Kadiyali et al. 1998).

Price changes

Lastly, we consider the effect of adjustments in the price of PLs for each PL tier. As NBs are, in general, higher priced than PLs, the NB-PL price differential [p(NB)-p(PL)] is positive (Sethuraman and Gielens 2014). In this respect, Hoch and Lodish (2001) advise retailers to maintain a large price gap between PLs (aggregated across tiers) and NBs as it leads to higher PL share by weaning consumers away from NBs. Pauwels and Srinivasan (2004) obtain similar findings, where they specifically focus on the standard PL tier. In contrast, if one focuses on profitability rather than sales or share, a large price gap between PLs and NBs is not necessarily desirable (Sethuraman and Raju 2012). In fact, if retailers close the objective and perceived quality gap between PLs and NBs, they can gain higher profits by also reducing the price gap (Raju, Sethuraman, and Dhar 1995; Sayman, Hoch, and Raju 2002). Moreover, Sethuraman and Raju (2012) state in a recent review paper that

given the profitable outcomes of increasing the price of PLs, 'the price differential can be reduced to near zero?'. However, the price differential (NB vs. PL) cannot be too low or zero, as consumers still are willing to pay a premium for NB image, even if they perceive the PL to be equivalent (Sethuraman 2003; Applebaum, Gerstner and Naik 2003).

Table 2-5 The impact of alternative price changes on net profit

Scenario's	**price increase by**	**%**	***Sainsbury's Profit***	***Asda Profit***
Below Standard PL	Economy PL	10%	0.60%	1.00%
		30%	1.50%	2.70%
		50%	2.30%	3.90%
Below Premium PL	Standard PL	10%	7.20%	8.50%
		20%	13.10%	15.10%
Below Mainstream NB	Premium PL	10%	2.10%	0.00%
		28%	N.A.	0.10%
Equal to Mainstream NB	Premium PL	13%	2.40%	N.A.
		43%	N.A.	0.20%
Above Mainstream NB	Premium PL	20%	3.30%	N.A.
		50%	N.A.	0.20%
Equal to Premium NB	Premium PL	27%	4.10%	N.A.

Notes: N.A. = not applicable scenarios for the retailer. % price increases are determined by taking into account certain price thresholds. For example, 10%, 30% and 50% price increase scenarios still make the economy PL cheaper than standard PL.

In what follows, we explore the impact of decreasing the gap between *standard PLs* and mainstream NBs by increasing the price of standard PLs by 10% and 20%. These price increases result in a demand drop for standard PLs, mainly in favor of mainstream and premium NBs, and the outside good. However, these price increases lead overall to a net category profit increase for both retailers. For instance, for Sainsbury's we observe a category profit increase of 7.2% and 13.1% and 8.5% and 15.1% for Asda (see Table 2-5). Hence, both retailers and NB manufacturers gain from this standard PL price increase, as it leads to a demand shift to NBs accompanied by a profit lift for the retailer.

Furthermore, Sethuraman and Gielens (2014) state that little is known about how *premium PLs* should be priced. Retailers are generally advised to set prices of their premium PLs slightly above

NBs prices (Kumar and Steenkamp 2007) or at parity (Millward Brown 2008). Items in the top tier of a supermarket's sub-brands are sometimes more expensive than the market leaders (World Trademark Review 2012). In our case, both retailers price their premium PLs below the NBs. As such, we conduct an experiment by increasing the price of premium PLs in order to decrease the price differential between premium PLs and NBs. Accordingly, we explore the following four scenarios: (i) Premium PL price + 10% (ii) Premium PL price equal to Mainstream NB price (i.e. + 13% for Sainsbury's and +43% for Asda) (iii) Premium PL price above Mainstream NB price (i.e. +20% for Sainsbury's and + 50% for Asda) and (iv) Premium PL price equal to Premium NB price (i.e. + 27% for Sainsbury's)[18] (see Table 2-5). Although the price increase of premium PLs results in a demand loss for itself, it is mainly in favour of standard PL and mainstream NBs and premium NBs. Note that the premium PL changes at Asda are very minor, which is due to the very small number of SKU's (i.e. 3). Our results suggest that a retailer should price its premium PLs above the mainstream and even equal to premium NBs in order to improve its net category profits.

The above discussion considered the profit impact of a price increase or delisting, holding the rival prices fixed. In practice, one can also consider the profit impact when the rivals respond. As a robustness analysis, we consider counterfactuals where rivals respond by half of the initiated price increase. For example, if the original initiated scenario is increasing the price of economy PLs by 10%, we also increase the price of all rivals (standard PL, premium PLs, mainstream and premium NBs) by 5%. A similar robustness analysis is done for all scenarios and group of brands. The results show that if competitors react by also increasing their prices, the retailer is better off by earning even more profits (see Table 2-10 in Appendix).

[18] At Asda, mainstream NBs are, on average, priced above premium NBs (i.e. 3.63 vs. 3.45), so we dropped scenario 4 for Asda.

In addition, we explore the extreme case where PL tier price is increased to infinity which equals to an *elimination of the entire assortment* flagged under a PL tier to identify who competes with whom (see Table 2-6). In line with Geyskens et al. (2010), the retailer's standard PL offerings benefit proportionately more from dropping the economy PL tier. Economy PL brand variants therefore clearly cannibalize the standard PL brand variants. Or in other words, providing an economy PL tier shifts consumer demand from the standard PL tier (and to a much smaller extent of premium PL tier in the case of Asda) to the economy alternatives. Still, the economy PL tier is able to attract considerable consumer demand from competing retailers, probably the hard discounters like Aldi & Lidl (see Vroegrijk et al. 2013). However, in total, deleting the economy PLs leads to a category profit increase of 1.9% for Sainsbury's and even 2.8% for Asda. Similarly, when standard PLs are eliminated from the retailer's assortment, the retailer's premium PLs and mainstream NB (and to a smaller extent premium NB in the case of Asda) offerings benefit comparatively more from this elimination by attracting more than their benchmark share or fair share. Standard PL alternatives mainly compete with the mainstream NBs (same quality tier but different brand type) and premium PLs (higher quality tier but same brand type). This first indicates that standard PLs are doing what they are designed for, competing with the mainstream NBs (see Kumar and Steenkamp 2007), but at the small cost that part of the standard PL demand comes from the (higher margin) premium PL alternatives. In line with the economy PL tier, the standard PL tier considerably attracts demand from competing retailers. Overall, adopting a standard PL tier leads to a category profit increase of 11.9% for Sainsbury's and 18.3% for Asda. Finally, when retailer's premium PL options are eliminated, the economy PL option is clearly unattractive for premium PL buyers, whereas the standard PL tier and mainstream and premium NBs gain share. This indicates that premium PLs are cannibalizing the standard PL sales (partly supporting the findings of Geyskens et al. 2010), but not the economy PL

sales. In this respect, Szymanowski and Gijsbrechts (2012) state that quality variation induced by the higher quality PL lines may dilute the signalling value of the standard PL brand. With regard to the economy tier, Palmeira and Thomas (2011) show that the quality perception of a value store brand (like the economy PL) are not affected by the presence of a premium store brand, which is supported by our findings. Irrespective of the cannibalization with the standard PL tier, the higher margin of premium PLs results in a profit increase of 3.3% for Sainsbury's and 0.1% for Asda.

Table 2-6 Who competes with whom?

Economy PLs	***Standard PLs***	***Premium PLs***	***Mainstream NBs***	***Premium NBs***	***Profit***
Sainsbury's					
Infinite price increase	(++)	=	=	=	1.90%
=	**Infinite price increase**	=	(++)	=	-11.90%
=	(++)	**Infinite price increase**	=	=	-3.30%
Asda					
Economy PLs	***Standard PLs***	***Premium PLs***	***Mainstream NBs***	***Premium NBs***	***Profit***
Infinite price increase	(++)	=	=	=	2.80%
=	**Infinite price increase**	=	(++)	=	-18.30%
=	(++)	**Infinite price increase**	=	=	-0.10%

Notes: N.A. = not available at the retailer; (=): (diversion ratio – fair share) <0.5; (+) : 0.5 < (diversion ratio – fair share) <1; (++) = (diversion ratio – fair share) >1 ; + and - : net profit respectively increases or decreases due to the elimination/introduction.

Consistent with Sethuraman and Raju (2012) and ter Braak et al. (2013), who refer to premium PLs as the high-margin tier, our results also show that the presence of a premium PL tier contributes positively to the retailer's profitability. In the case of Asda, the impact of elimination of the premium PL tier is minor, which is due to the very low number of premium PL SKU's currently offered at the retailer. In sum, economy buyers switch mainly to the retailer's standard PL options, whereas standard and premium PL buyers mainly switch to each other as well as NB options. Overall, adopting an

economy PL tier leads to a category profit decrease, however standard and premium PLs positively affects category profits.

Lastly, given that providing economy tier in the assortment does not generate additional profit in all levels (whole tier, line or brand variant), we experiment with *the prices of the economy tier* by increasing the price 10%, 30% and 50% to check whether without dropping the tier, any increase in the prices result in a profitable way (see Table 2-5). Our results also show that although the price increase of economy PLs results in a demand loss for itself mainly in favor of standard PL, mainstream and premium However, in total economy PL's price increase leads to a category profit increase of 0.6%, 1.5% and 2.3% for Sainsbury's and 1%, 2.7% and 3.9% for Asda respectively.

In brief, these price counterfactuals display that a PL price increase, irrespective of the tier, results in a further improvement of a retailer's category profits accompanied with an increased demand for the NB alternatives.

Differences between retailers

The above findings reveal some interesting differences between our two focal retailers, Sainsbury's and Asda. Overall, in the different scenarios, the competition between the different PL tiers and lines turns out to be stronger at Asda relative to Sainsbury's. This might be driven by the fact that the price gap between the three PL tiers is much smaller at Asda than at Sainsbury's. As indicated by Sethuraman (1995), cross-competitive effects are stronger when the price gap between two brands is smaller because the two brands will be more likely to enter a consumer's consideration set (see also Gielens 2012 for a similar reasoning in a new product introduction setting).

2.6 Discussion

Worldwide, more and more retailers are carrying multiple PL tiers within a category. In fact, the importance (and number) of economy and premium PLs, next to the standard PLs, has increased as has a range of PL lines focusing on healthy eating, kids and organic foods (Planet Retail 2013). However, what are the implications of this ongoing PL proliferation into tiers and lines on competition between both PL and NB brand variants in a retailer's assortment, and subsequently on retailer's profits?

If we first explore the overall competition between PL tiers (irrespective of PL lines within a tier), our findings indicate that economy and premium *PL tiers* mainly cannibalize the standard PLs, which confirms prior insights (Geyskens et al. 2010). On top of this, our study reveals that standard PLs partly cannibalize premium PLs. Despite the cannibalization between PLs, all PL tiers are able to attract sales from competing retailers, and, except for the economy PLs, to ameliorate category profitability. Still, contrary to standard and premium PLs, the acquired low-priced economy PL sales, coming not only from competing retailers but form other (higher-priced) alternatives at the focal retailer, result in a less profitable situation. On top, our price simulation reveal that retailers can strengthen their category profitability by closing the price gap between their PL offerings and the NB alternatives. This strategy comes at a cost of losing PL sales but boosts more profitable NB sales. Interestingly, a retailer can uplift the profit generated by its economy tier by upgrading its price. Likewise, a retailer can further improve its profits by increasing the prices of its standard PL products, despite the switch of some of their standard PL buyers to mainstream and premium NBs. Similar, a price increase for the premium PL brand variants improves profits.

Overall, very similar patterns are observed with regard to *PL line* extensions and deletions within a PL tier. All line extensions (i.e. kids, muesli and health) in the premium PL tier cannibalize

standard PLs (but not the economy PLs) but, in contrary to the tier level, to also steal business from the mainstream and premium NBs with the same attribute (i.e. kids, muesli and health), resulting in a profitable outcome. Most standard PL line extensions (i.e. kids, muesli and health) again steal demand from own premium PLs (not economy PLs) but also from mainstream NBs and improve retailer's profitability. Only for the economy PLs, our findings indicate that at all levels (i.e. whole tier, line and brand variant) retailers do not earn additional profits with their low-priced offerings, questioning their excessively large assortment. However, for retailers pursuing objectives other than profit maximization, like generating store traffic or competing with hard discounters (see Vroegrijk et al. 2013), an appropriate strategy would be to simply reduce this tier's assortment, instead of dropping it altogether.

These findings are consistent with recent business practices. More and more retailers are (i) further proliferating their standard and premium PL assortment, and (ii) boosting the price of their economy PL alternatives. Firstly, U.S.'s third largest food retailing company Supervalu expanded its PL business in 2012 with another 1,500 new products of medium and premium quality, including a line of natural and organic foods called Wild Harvest (Market Watch 2012). Likewise, U.S. retailer Kroger has expanded its organic and healthy (standard and premium) PL lines recently (Market Watch 2012). According to a report of Food Product Design (2015), there is opportunity to increase category participation by introducing more premium product lines featuring organic, healthy products (Food Product Design 2015). This reasoning is supported by our findings that indicate that introducing a healthy line under the premium tier umbrella attracts considerable amount of share from competing retailers.

Secondly, there is an ongoing discussion in the grocery retailing whether introducing economy PLs is really a right strategy to fight with discounters and in the end the net effect of this strategy for

the retailer is a big question mark in terms of profitability. Koen de Jong who is Managing Partner, International Private Label Consult (IPLC) claim that "many mainstream retailers have expanded or re-launched their economy PL lines to mitigate the risk of losing shoppers to discounters. However, we believe that negative effects may result from this strategy. Economy PLs generate lower margins to retailers than NB equivalent PLs. As a result, offering economy PLs may lead to an erosion of category profitability due to cannibalizing effects". Indeed, the top grocery retailers in UK (i.e Tesco, Sainsbury's and Asda) have increased the price of more than 40 per cent on average of their economy PLs in the previous years given that rising commodity costs and food inflation put pressure on the profitability of the bottom line (Daily Mail 2013). Both Tesco and Sainsbury's indicate that despite price rises, their economy ranges are as popular as ever (Daily Mail 2012).

Limitations and Further Research

Our research has several limitations that offer interesting avenues for future research. First of all, our analysis focuses only on *one* FMCG category and *two* (leading) retailers, which prevents us to generalize our findings. Future research should study NB-PL competition across a large set of product categories but also within a large set of retailers, in order to generalize our findings, but especially to study moderating retailer and category effects. In this respect, ter Braak et al. (2014) already reveal that retailers introduce premium PLs in some categories but not in others.

Second, although the inclusion of the outside good in our model allows for flexible substitution towards other retailers' offerings, further insights are needed into which retailers attract these lost sales. For the economy PLs case, one can expect that consumer switch to offerings of hard discounters (like Aldi & Lidl) and maybe economy PL offerings of competing traditional retailers as economy PLs are strategically introduced to fight with these alternatives (Dekimpe et al. 2011 and Vroegrijk et

al. 2013). Likewise, with regard to for the standard and premium PLs, consumers might switch to traditional retailers' NBs, but also their standard and premium PL offerings. Hence, further research is called for the study this inter- and intra-tier completion not only within a retailer but across retailers, helping retailers in further mapping out their own PL strategy.

Third, in our counterfactual analysis, we held the prices of the rival alternatives at the retailer constant. In our sensitivity analysis, we already considered partial rival price responses to a price increase for a PL alternative, and we find even stronger profit effects. In reality, the prices of competing offerings might also increase as a reaction to an entirely new tier/line/brand variant delisting (and vice versa for the introduction of a new PL alternative). Future research should further study the net result of these simultaneous actions.

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Table 2-7 Sainsbury's Estimation Results

Variables	Mean	Std. dev	Interactions with household characteristics				
			# of children	Low class	Middle class	Buying Frequency	SoW
Price	-1.081***	0.534***	0.0552***	-0.159***	-0.113***	-0.00273	0.197***
	(0.0424)	(0.0109)	(0.0140)	(0.0386)	(0.0311)	(0.00459)	(0.0358)
Outside Good	7.513***	2.888***					
	(0.161)	(0.0642)					
Assortment	0.0854***						
	(0.0103)						
Loyalty	11.93***						
	(0.0583)						
Lines							
Kids			0.327***	0.129**	0.0943**	-0.0514***	0.0354
			(0.0146)	(0.0505)	(0.0398)	(0.00885)	(0.0648)
Health			-0.220***	-0.128***	0.0139	-0.0155**	-0.177***
			(0.0161)	(0.0455)	(0.0349)	(0.00780)	(0.0586)
Muesli			-0.137***	-0.317***	-0.0865	0.00788	0.474***
			(0.0294)	(0.0804)	(0.0589)	(0.0128)	(0.103)
Brand type vs. quality tiers							
Economy PL			-0.294***	0.973***	0.237	0.126***	3.015***
			(0.0876)	(0.214)	(0.145)	(0.0198)	(0.150)
Standard PL			-0.268***	0.528***	0.0521	0.0306*	3.652***
			(0.0772)	(0.193)	(0.126)	(0.0166)	(0.116)
Premium PL			-0.466***	0.525**	0.134	0.0332	3.445***
			(0.0863)	(0.219)	(0.149)	(0.0240)	(0.179)
Mainstream NB			-0.175**	0.539***	0.0479	0.0542***	3.323***
			(0.0792)	(0.205)	(0.137)	(0.0198)	(0.148)
Premium NB			-0.382***	0.572***	0.141	0.0413**	3.541***
			(0.0793)	(0.204)	(0.137)	(0.0200)	(0.145)
Brand Variant Dummies	Yes						

*** p<0.01, ** p<0.05, * p<0.1

Note: The parameter estimates and std. errors (in parentheses) of the mean effects are shown in the first column. Column 2 shows estimates of the random coefficients, while columns 3-6 show estimates of the household characteristics interacted with price and brand variant characteristics.

Table 2-8 Asda Estimation Results

Variables	Mean	Std. dev	Interactions with household characteristics				
			# of children	Low class	Middle class	Buying Frequency	SoW
Price	-0.982***	0.614***	0.0990***	-0.00670	0.0518	0.0166***	-0.0716**
	(0.0409)	(0.0107)	(0.00968)	(0.0354)	(0.0320)	(0.00336)	(0.0319)
Outside Good	7.479***	3.024***					
	(0.153)	(0.0487)					
Assortment	0.0626***						
	(0.00928)						
Loyalty	11.65***						
	(0.0492)						
Lines							
Kids			0.278***	0.340***	0.147***	0.00132	0.183***
			(0.0101)	(0.0383)	(0.0338)	(0.00504)	(0.0488)
Health			-0.206***	-0.127***	-0.186***	-0.0270***	0.274***
			(0.0149)	(0.0486)	(0.0423)	(0.00721)	(0.0652)
Muesli			-0.157***	-0.0471	-0.0174	-0.00520	-0.0651
			(0.0245)	(0.0798)	(0.0684)	(0.0110)	(0.101)
Brand type vs. quality tiers							
Economy PL			-0.247***	0.538***	0.445***	0.0205	4.333***
			(0.0413)	(0.155)	(0.139)	(0.0133)	(0.116)
Standard PL			-0.362***	0.107	0.260*	0.00906	4.526***
			(0.0401)	(0.149)	(0.133)	(0.0121)	(0.103)
Premium PL			-0.627***	-0.0601	0.123	0.0226	3.872***
			(0.0851)	(0.268)	(0.226)	(0.0320)	(0.308)
Mainstream NB			-0.384***	0.323**	0.416***	-0.0424***	4.536***
			(0.0428)	(0.159)	(0.142)	(0.0142)	(0.126)
Premium NB			-0.514***	0.242	0.353**	-0.0759***	4.721***
			(0.0423)	(0.157)	(0.140)	(0.0139)	(0.121)
Brand Variant Dummies	Yes						

*** p<0.01, ** p<0.05, * p<0.1

Note: The parameter estimates and std. errors (in parentheses) of the mean effects are shown in the first column. Column 2 shows estimates of the random coefficients, while columns 3-6 show estimates of the household characteristics interacted with price and brand variant characteristics.

Appendix

Table 2-9 Introducing/Delisting Kids Lines from the Tiers (Asda)

		Economy PL		Standard PL		Premium PL		Mainstream NB		Premium NB		Outside Good	Net Profit
		Kids	**Non-kids**	**Kids**	**Non-Kids**	**Kids**	**Non-Kids**	**Kids**	**Non-Kids**	**Kids**	**Non-Kids**		
Diversion Ratio Full Model	**Introduce**	4.3%	15.6%	17.0%	N.A.	0.3%	4.3%	16.7%	8.2%	17.4%	16.2%		
Inside Good DR Full Model	**Introduce**	5.1%	18.6%	20.2%	N.A.	0.4%	5.2%	19.9%	9.8%	20.8%			
Inside Good DR Benchmark	**Introduce**	6.6%	17.0%	18.0%	N.A.	0.4%	5.2%	21.0%	9.4%	22.5%			
Δ Profit		0.1%	0.0%	-0.1%	-0.1%	N.A.	0.0%	0.0%	-0.1%	0.0%	-0.1%		**-0.23%**
Diversion Ratio Full Model		N.A.	4.6%	**Drop**	18.3%	N.A.	0.3%	5.8%	18.8%	9.9%	17.9%	24.3%	
Inside Good DR Full Model		N.A.	6.1%	**Drop**	24.2%	N.A.	0.5%	7.6%	24.9%	13.1%	23.7%		
Inside Good DR Benchmark		N.A.	7.9%	**Drop**	21.7%	N.A.	0.5%	6.2%	25.3%	11.3%	27.1%		
Δ Profit		N.A.	0.2%	-23.7%	3.1%	N.A.	0.1%	1.1%	3.3%	1.7%	2.9%		**-11.4%**
Diversion Ratio Full Model		N.A.	3.91%	12.90%	15.71%	**Introduce**	0.49%	3.80%	15.49%	6.93%	15.90%	24.87%	
Inside Good DR Full Model		N.A.	5.20%	17.17%	20.92%	**Introduce**	0.65%	5.06%	20.62%	9.22%	21.16%		
Inside Good DR Benchmark		N.A.	6.61%	16.85%	17.91%	**Introduce**	0.47%	5.32%	21.50%	9.26%	22.08%		
Δ Profit		N.A.	0.00%	-0.01%	-0.01%	0.09%	0.00%	0.00%	-0.01%	0.00%	-0.01%		**+0.04%**

Table 2-10 Sainsbury's and Asda net category profits by including competitors' reactions

Scenario's	**price increase by %**		***Sainsbury's Profit***	***Asda Profit***
Below Standard PL	Economy PL	10%	(+) 18%	(+) 18%
		30%	(+) 52%	(+) 51%
		50%	(+) 82%	(+) 79%
Below Premium PL	Standard PL	10%	(+) 22%	(+) 22%
		20%	(+) 42%	(+) 42%
Below Mainstream NB	Premium PL	10%	(+) 22%	(+) 19%
		28%	N.A.	(+) 47%
Equal to Mainstream NB	Premium PL	13%	(+) 25%	N.A.
		43%	N.A.	(+) 68%
Above Mainstream NB	Premium PL	20%	(+) 47%	N.A.
		50%	N.A.	(+) 83%
Equal to Premium NB	Premium PL	27%	(+) 51%	N.A.

Note: Sainsbury's and Asda's net category profit changes are calculated by taking into account competitors' price response. We assume that competitors also increase their prices by half of the original brand's price change (e.g. if price of the economy PL is changed by 10%, competitors react by changing their prices 5%).

Derivation of choice probabilities

Assume that household i chooses the brand variant j that maximizes utility among all the available alternatives, conditional on household i's available choice set. Then the probability that household i chooses brand variant j is given by:

$$Pr_{ij}(v_i) = \frac{\exp(\gamma_{ij} + \beta_i X_{jt} + \alpha_i p_{jt} + \theta_i I_{ijt} + \xi_{jt})}{1 + \sum_{k=1}^{J} \exp(\gamma_{ik} + \beta_i X_{kt} + \alpha_i p_{kt} + \theta_i I_{ikt} + \xi_{jt})} \quad \text{(A1)}$$

With unobserved heterogeneity, it is necessary to integrate the conditional choice probability Pr_{ij} over the unobserved individual term v_i (containing the unobserved individual-specific valuation of price and the outside good, as discussed in the text). Then, we obtain the random coefficients logit choice probability:

$$s_{ij} = \int_{v} Pr_{ij}(HHchar, v_i)\, dF(HHchar, v_i) \quad \text{(A2)}$$

Following Train (2003), to approximate the integral in (A2), we take R draws for v_i from the

standard normal distribution to obtain average choice probability for each household:

$$s_{ij} = \frac{1}{R}\sum_{r=1}^{R} \frac{\exp(\gamma_j^0 + \beta_i X_j + \theta_i I_{ij} - (\alpha^0 + \sigma v_i^r)p_{ij} + \left(PGdummy_p, p_{ij}\right)\Pi HHchar_i)}{1 + \sum_{k=1}^{J} \exp(\gamma_k^0 + \beta_i X_k + \theta_i I_{ik} - (\alpha^0 + \sigma v_i^r)p_{ik} + \left(PGdummy_p, p_{ik}\right)\Pi HHchar_i)} \quad \text{(A3)}$$

where Π denotes the matrix of parameters capturing the impact of household characteristics on the valuation for the product group dummies $PGdummy_p$ and price p_{ij} (as it denotes $\gamma^{hp}$and α^h). To estimate the parameters, we use the method of simulated maximum likelihood, where the choice probabilities (A3) form the basis for the likelihood function.

Chapter 3 The Battle of Traditional Retailers versus Discounters: The Role of PL Tiers[19]

3.1 Introduction

The rise of the discounters is a key driver of structural change within the grocery retailing (The Independent 2014). Their market shares range from about 10% to an astonishing 43% in Germany (Global Retail Mag 2014) and they are estimated to grow by 82.2% between now and 2020, according to grocery think-thank IGD (Food Manufacture UK 2015). Their growing popularity is not a passing fad or their success is not limited to recession periods. They have become a sustainable player of the grocery market (Planet Retail 2014). They compete on price, quality, consistency and simplicity. Discounters apply their no-frills approach, products are often displayed on the floor on pallets and retail-ready; half-sized pallets are used to further optimize floor space (Cleeren et al. 2010; AT Kearney 2011). Their sales rely primarily on private labels (PLs) and, recently, they offer a limited number of national brands (NBs). In 27 countries of European Union (EU-27), on average, about 80% of discounters' sales come from PLs (AT Kearney 2011). Discounters offer a minimal assortment of around 1,300 to 1,400 products, compared to the 30,000 you have in a supermarket. Hence, by keeping the number of products to a minimum on PLs, they are able to deal with far fewer suppliers and that helps to keep costs down (BBC 2015; IGD 2011). Above all, prices are very low. By economizing on assortment and service, discounters are able to offer their PL products at rock-bottom prices (Lin et al. 2012).

[19] This chapter was written together with my supervisors Frank Verboven and Lien Lamey. It was published in Journal of Retailing and Consumer Services 39 (2017): 11-22.

Nowadays, over half of UK shoppers, 51%, visit a discount food store each month and in the past two years the number of consumers who use discounters for their main weekly shopping has more than doubled, from 5% to 12% (ITV News 2014). For the traditional retailers, the gains of Aldi and Lidl have been like the arrival of a new predator (BBC 2015). As discount grocery retailers increasingly meet the needs of European consumers, traditional retailers are seeing their profits plummet and market shares shrink (BCG 2016). When discounters enter a local market, traditional retailers are severely affected and incur sales losses of approximately 17% on average (Ailawadi et al. 2010; Vroegrijk et al. 2013). However, if they locate close to traditional retailers, some loss can be mitigated since becoming part of a twin location with the discounters may turn the traditional supermarket into an attractive option for combined visits (Vroegrijk et al. 2013) and might result in a or create win-win situation for both traditional retailers and discounters through inter store synergy and increased consumers' spending (Ailawadi et al. 2010; Singh, Hansen, and Blattberg 2006). Moreover, discounters not only affect traditional retailers' market share, they also put pressure on them to increase operational efficiency and/or decrease prices (Cleeren et al. 2010; van Heerde et al. 2008). Consumers with the lowest willingness to pay for NBs were attracted by discounters' cheap PL products, reducing the customer base of the incumbent retailers (Bergés-Sennou, Bontems and Réquillart 2004). The boss of UK-based Morrisons has declared that the competition from discount grocers Lidl and Aldi have thrown the supermarket industry into its biggest crisis since its birth in the 1950s (The Independent 2014).

To fight back against discounters (but also other retailers), traditional retailers started to view their PLs much more strategically and begun to explore new growth opportunities via multi-tier PL strategies (Food Navigator 2015). This ranges from the typical cheap and low quality own labels (i.e., economy PLs) to somewhat less expensive PLs comparable in quality to the national

brands (NBs) (i.e., standard PLs), to premium quality and high value added PLs (i.e., premium PLs) (Kumar and Steenkamp, 2007). With this strategy, retailers can provide a quality point of differentiation compared to their competitors (PLMA 2011). Whereas national brands (NBs) are available in all retailers' assortment and shoppers can find them in any retailer, PLs have restricted distribution that is unique to the retailer (Chen, Narasimhan and Dhar 2010). Hence, with increasing competition among retailers, PL tiers are now set to become the new battle ground (Food Navigator 2015). In fact, an increasing number of retailers is adopting a multi-tier PL strategy (Brand Packaging 2014).

Established retailers typically compete with discounters via entry-price PLs (economy PLs) with a pricing strategy of 2% to 16% lower than the prices of discounters (Global Retail Mag 2014). However, one of the managerially highly relevant questions is whether this is a right strategy for the traditional retailers. Managing Director of International PL Consult states that "introducing economy PL strategy can backfire since economy PLs generate lower margins than standard PLs and most importantly they can cannibalize the current PL offerings" (Global Retail Mag 2014). Moreover, a shopper survey conducted by IGD revealed that 27% of UK shoppers believe the quality of discounters' PLs are comparable to standard PLs of the traditional retailers, 20% said they are very similar to NBs and 7% even think that they are even better than anything sold in a traditional supermarket (Just Food 2015). The numbers are impressive and challenge the idea that discounters' PLs are inferior and the real competitor might be standard PLs of traditional retailers not economy PLs. Furthermore, some practitioners even advise to adopt a completely opposite PL strategy in the discounter battle, i.e., to offer high quality premium PLs with higher prices where discounters cannot match the traditional retailers' quality and experience (Supermarket News 2014; Vroegrijk et al. 2016). Therefore, traditional retailers need to emphasize

what they offer that discounters can't (BBC 2015). In sum, the opinions on which PL tier is the best strategy in response to such discounters' threat is diverse and empirical evidence is limited. Hence, it is important to shed light on the demand effects of PL tier strategy for the market players.

This study contributes to the existing PL tiers and retailer (format) competition literature in two ways. First, while there have been some studies focusing on inter-tier competition only *within a retailer* (e.g., Geyskens et al. (2010) and Gielens (2012)), we are – to the best of our knowledge – the first to investigate the inter-tier competition *across retailers* by adding the retailer dimension in our study. Second, although retailer (format) competition has been widely analyzed in the literature (e.g., Gonzales-Benito et al. (2005); Gijsbrechts et al. (2008); Briesch et al. (2009); Cleeren et al. (2010); Haucap et al. (2013)), we are the first to systematically investigate the role of *PL tiers* in retailer (format) competition (in the context of traditional versus discount retail formats).

Hence, our work builds on two streams of literature. The first stream focuses on PL tiers, but ignores competition across retailers. Within this area, most scholars study the impact of PL tier introductions on category sales and incumbents' market shares within a given retailer. Geyskens et al. (2010) show that, based on a brand-choice model with context effects, the introduction of an economy PL cannibalizes the incumbent standard PL but benefits the mainstream NBs. Similarly, an introduction of a premium PL cannibalizes the incumbent PLs (i.e. budget and standard) and sometimes benefits premium-quality NBs. Gielens (2012) studies the impact of PL and NB introductions on category sales and the share of the top NBs and the three PL tiers (aggregated over brand variants). She finds, among other things, that new products introduced by standard PLs and premium PLs are sometimes able to boost category sales, to shrink NB rivals' shares, and to

cannibalize other PL tiers (respectively, economy and premium, and only economy), whereas new products introduced under the economy PL flag only stimulates the overall economy PL share.

The second related literature stream bears on retailer (format) competition, without considering the role of PL tiers. Gonzales-Benito et al. (2005) analyze the role of store format in retail competitive interactions. They find that there is greater spatial rivalry *within* store formats (intra-format) than *between* store formats (inter-format). Gijsbrechts et al. (2008) also indirectly study the competition between supermarkets by using a spatial interaction model. They examine the non-promotional motives for multiple-store shopping by incorporating shopping patterns (single-, separate-, or combined-store visits) and related shopping decisions. Their main finding is when stores are category-preference complements, such as in the case of a supermarket and a hard discounter, a location close to the complementary store may actually have the opposite impact. Hence, by facilitating combined-store visits, the location may create an 'attraction' effect and even provide benefits to chains, allowing them to 'team up' against more remote competitors that have an appealing offer across the board. Lastly, Cleeren et al. (2010) and Haucap et al. (2013) study inter-format retail competition between traditional retailers and discounters. They find that there is intense competition within both the traditional and discount format, although the competition between traditional retailers is more severe. However, they do not explicitly study the switching behavior of consumers among the traditional retailers and discounters and do not identify which brands compete with each other across retail formats.

Although the inter-tier PL and/or NB competition *across retailers* has recently been recognized as being of great managerial interest (BBC 2015; The Guardian 2014), to the best of our knowledge it lacks empirical research with two notable exceptions. Dawes and Nenycz-Thiel (2013) study the intensity of PL competition across retailers. By using a purchase duplication

analysis, they identify which buyers of one brand also appear as buyers of another brand. More specifically, they explore whether buying one PL increases the tendency to buy a different retailer's PL in the same category. They find that PLs compete against NBs within-retailer, but also compete against the PLs of other retailers across retailers. But, they only focus on standard PLs (not taking into account the other tiers) and more importantly they don't include discounters in their study. Secondly, Vroegrijk et al. (2016) is the first study to explicitly investigates how economy PLs affect the retailer's category sales before and after hard discounter entry. They find that economy PLs are not a good defense tool against hard discounters. However, the important question still remains same. If the economy PLs are not an effective tool in this battle, which PL strategy is best for traditional retailers? And what could be alternative strategies in terms of pricing or other competitive tools (e.g. assortment depth)? Recently, ASDA and Morrisons, the UK's 'Big Four' supermarkets with the largest overlap with discounters, have reacted to discounters by announcing a round of price cuts for their PLs (Reuters 2014). Alternatively, traditional retailers also offer price cuts for their NB offerings instead of decreasing the price of standard PLs. Tesco recently announced that they will fight back against the growth of discounters by cutting the price of hundreds of branded products including Hovis bread, Kellogg's cornflakes and some other NBs (Reuters 2015). In the meantime, discounters not only focus on their PLs but increasingly introduce NBs in their assortments. Aldi now announces the introduction of major NBs into their assortment (Distrifood 2012).

The purpose of our study is to shed light on these issues by formally investigating (i) which PL tier is the most effective for the traditional retailers in the battle with the discounters; (ii) how traditional retailers should adjust the pricing of their PLs and NBs to respond to the discounter threat; and (iii) whether discounters should expand the NB presence in their stores to further steal

demand from the traditional retailers? To answer the above research questions, we estimate a demand model at the consumer level. This model allows for the calculation of counterfactual experiments that predict consumer responses to both *assortment* and *price* changes in the PL-NB choice set of traditional retailers and discounters.

The rest of the paper is organized as follows. In the next section, we provide a brief overview of the industry and the data, followed by a section that presents the empirical framework with more detail regarding the method of estimation. In section 3.4, we present the empirical results and the implied elasticities. In section 3.5, counterfactuals are discussed in detail. Section 3.6 presents the discussion with managerial implications, and finally we conclude the paper in section 3.7 with limitations and ideas for further research.

3.2 Data

To answer our research questions, we obtained household purchase records of a representative sample of UK households (Kantar Worldpanel UK) for the ready-to-eat cereal (RTE) category and canned soup category for the period between January 1, 2009 and December 31, 2010, provided by AiMark. First, both categories enjoy high penetration of PL-tier introduction so three-tier PLs are present at the traditional retailers. Second, PL and NB alternatives are present at the discounters. Finally, no re-brandings of PLs and NBs, or major PL or NB entries or exits occur (i.e. a mature markets) during our observation period. Irrespective of these selection criteria, our two categories strongly differ with respect to several potential drivers of PL/NB competition across retailers. First of all, NBs consists of only 21% of the soup category, however in the RTE cereal category NB share reaches to 45%. Therefore, this gives us the chance of generalizability of the results among the categories who reveals different PL-NB concentration. Second, the average

yearly category purchase frequency highly differs for the cereal and canned soup category (i.e. cereal: 24 and soup: 6). Higher rate of category purchasing corresponds to greater cross-shopping across retailers (Narasimhan and Wilcox, 1998) because frequent purchasing affords opportunity to shop at multiple retailers. This gives us another chance in terms of generalizability of the results across categories.

Our major advantage of this data set over the other data sets used in PL research is that we use the data comprising purchases across multiple retailers whereas previous studies usually cover only one retailer (e.g. Hansen et. al. 2006) or focus on each retailer separately (e.g. Geyskens et. al. 2010). We focus on all UK leading grocery retailers with a (volume) market share above 2% for each category. Accordingly, five traditional retailers (i.e. Asda, Morrisons, Tesco, Tesco Extra and Sainsbury's) and two discounters (Aldi and Lidl) are selected, covering in total 82.3% of the UK grocery market. The discounters have a combined market share of 5.62% and 5.89%, for the canned soup and cereal category[20].

The UK market is considered as one of the most sophisticated PL markets in the world, with a PL share above 45% (PLMA 2014), where all retailers are offering a well-established three-tiered PL program. Moreover, discounters affect prices well beyond their own stores and pose fierce competition (The Guardian 2013). As a result, UK's biggest supermarkets are being squeezed out by discounters (The Guardian 2013). As such, "There's a massive global price-war in food retailing, much of it provoked by the gains by Aldi and Lidl and other discounters," (The Economist 2008). Likewise, Tesco, the world's fourth-biggest retailer, is engaging a price war against Lidl (The Economist 2008). In terms of speed of growth, according to retail analysts, the

[20] We have conducted our analysis for the years between 2009 and 2010. In those years, average combined market share of two leading discounters (i.e. Aldi and Lidl) is 4.5% across all categories in U.K (Nielsen 2013). Hence, the reported market shares for the selected categories are quite representative for the rest of the market.

UK will be the fastest growing European market for hard discounters, growing at an 11% compound annual growth rate between 2013 and 2018. This prediction is underpinned by rapid investment and expansion plans – Aldi plans a 67% expansion to 1,000 outlets by 2022. Meanwhile, Lidl has long-term plans to more than double its number of stores in the UK to around 1,500 (AHDB 2015). Hence, all these facts make the U.K supermarket industry an interesting place to study.

Table 3-1 presents the summary statistics of canned soup and RTE cereal category. This table reports per category the average price in equivalent units, the number of SKUs and volume market shares for each product group: economy PLs, standard PLs, premium PLs, NBs at traditional retailers, discounter PLs and NBs at discounters.[21] We divided traditional retailers' PL brands into three quality tiers: low (*economy PLs*), medium *(standard PLs*), and upper (*premium PLs*), next to the NBs. Likewise, discounters' offerings are grouped as discounter PLs and NBs.

In both categories, economy PLs form the cheapest product group at the traditional retailers. Assortment depth is highest for the standard PLs, and premium PLs capture the lowest market share at traditional retailers. Moreover, discounters price their PLs between the traditional retailers' economy and standard PLs in both categories. This already challenges the conventional belief that economy PLs and discounter PLs are in the same league in terms of price competition. Furthermore, discounters set NB prices below traditional retailer NB counterparts which makes them the cheapest outlet for NB buyers. Lastly, the discounters' assortment relies heavily on PLs, and the majority of the sales volume within discounters consists of PLs.

[21] We adopt the classification used by Geyskens et al. (2010) to group each private label into a quality tier. In addition to this, we have also validated this classification ourselves with the Planet Retail's PL reports as a final check.

In terms of category differences, premium PLs are more expensive than NBs in the soup category compared to the cereal category. Assortment depth in all product groups as well as PL penetration is higher in the cereal category than in the soup category.

NBs and standard PLs of the traditional retailers have almost equal share within traditional retailing format (44.98% and 40.42% respectively) in the cereal category. However, in the soup category, NBs of the traditional retailer capture most of the market share. Moreover, the premium PLs' share is also larger in the soup category than in the cereal category. Finally, discounters offer more NB options in the soup category than in the cereal category.

Level of Aggregation

In line with prior work, we aggregate products across sizes and brand variants to the product level (Chintagunta, Bonfrer, and Song 2002; Pauwels and Srinivasan 2004; Geyskens et al. 2010). Next, similar to Villas-Boas (2007) and Draganska et al. (2010), we model retailer-brand combinations as the alternatives in the choice set to allow for retailer influences on choice behavior. In other words, the same product sold by two different retailers is treated as two different alternatives. For example, buying Kellogg's at Sainsbury's may be a very different experience than buying Kellogg's at Aldi because of price, shelf allocation, display, etc. For the traditional retailers, we select NBs that cover 70% of total sales of the retailer, implying that the selected brands may differ between retailers[22]. For the PLs, all brands under premium, standard and economy tiers are included. For the discounters, all available PLs and NBs are selected. For the PL selection, we aggregate brands into tiers and construct economy, standard and premium PLs product groups. We

[22] For example, we observe "Alpen" brand among Asda, Morrisons, Sainsbury, Tesco and Tesco Extra but not at Lidl and Aldi.

Table 3-1 Summary Statistics

Canned Soup	***Price (per Liter)***				***# SKUs***				***Volume market shares (%)***			
	mean	**min**	**max**	**SD**	**mean**	**min**	**max**	**SD**	**mean**	**min**	**max**	**SD**
Economy PLs	0.50	0.46	0.64	0.08	3	2	4	1	10.99	7.65	14.10	2.91
Standard PLs	1.21	1.10	1.40	0.11	23	19	26	2	40.42	24.69	45.83	8.90
Premium PLs	2.52	1.24	3.82	1.21	4	2	9	3	3.59	0.59	11.81	4.67
Traditional NBs	1.89	1.84	1.93	0.04	22	21	24	2	44.98	32.00	64.96	12.38
Discounter PLs	0.99	0.88	1.11	0.16	12	9	15	4	88.07	80.04	96.11	11.36
Discounter NBs	1.64	1.52	1.77	0.18	3	3	4	1	11.92	3.88	19.95	11.36
RTE Cereal	***Price (per kilo)***				***# SKUs***				***Volume market shares (%)***			
	mean	**min**	**max**	**SD**	**mean**	**min**	**max**	**SD**	**mean**	**min**	**max**	**SD**
Economy PLs	0.93	0.79	1.02	0.12	5	3	7	2	6.74	2.82	10.46	2.72
Standard PLs	2.12	1.98	2.28	0.12	42	35	48	5	70.56	68.97	71.41	0.95
Premium PLs	2.92	2.72	3.43	0.29	2	1	4	1	0.82	0.49	1.14	0.25
Traditional NBs	3.61	3.49	3.88	0.17	18	17	19	1	21.86	18.42	27.70	3.48
Discounter PLs	1.92	1.73	2.11	0.27	24	24	24	0	97.81	96.79	98.82	1.43
Discounter NBs	3.60	3.42	3.86	0.31	2	2	3	1	2.18	1.17	3.20	1.43

Note: This table reports the summary statistics of the product groups. Mean, min, max and sd show the variations across retailers.

adopt the classification of Geyskens et al. (2010) to group each brand into a quality tier (i.e. low, medium or high quality), which is based on the retailers' positioning of the private labels. We grouped the other retailer-brand combinations into a composite "outside" product with an average market share of 23.3% and 21.6% for the canned soup and RTE cereal category respectively.

To gain first insights into the competition between the traditional and discount retail format, we check whether households visit both discounters and traditional retailers to fulfil their category needs. Table 3-2 shows the multi format shopping pattern over six months and one year for each category.

Table 3-2 Distribution of household visits among the traditional retailers and discounters

	6 months window	**1 year window**
Soup		
Only Traditional retailers	11,627 (81.5%)	15,387 (77.5%)
Only Discounters	759 (5.3%)	767 (3.9%)
Traditional retailers & Discounters	1,884 (13.2%)	3,692 (18.6%)
Total hh in sample	14,270	19,846
Cereal		
Only Traditional retailers	17,418 (76.0%)	19,550 (70.9%)
Only Discounters	672 (2.9%)	535 (1.9%)
Traditional retailers & Discounters	4,838 (21.1%)	7,504 (27.2%)
Total hh in sample	22,928	27,589

With regard to the 6-month window, we see that the majority of the households in our sample only shop at traditional retailers (on average 80% in both categories). The share of households who solely visit discounters to buy canned soup (cereal) is 5.3% (2.9%). One important observation is that the share of households who visit both discounters and traditional retailers is higher in the cereal category (21%) than in the soup category (13.2%). Similar percentages are observed for the one-year window.

3.3 Methodology

Demand Model

Consumer demand is modeled using a discrete-choice setting. We apply a random coefficients logit model for each category (i.e. RTE cereal and canned soup). Households select a brand at a given retailer to maximize their utility[23]. We define the product as a particular brand (indexed by b) sold at a particular retailer (indexed by r). The indirect utility of household i from buying brand $b = 1,2, \dots, B$ from retailer $r = 1,2, \dots, R$ at weekly shopping trip[24] $t = 1,2, \dots, T$ is given by:

$$U_{ibrt} = \gamma_{irb} + \omega_i I_{ibt} + \varphi_i H_{irt} - \alpha_i p_{brt} + \beta_i A_{brt} + \epsilon_{ibrt} \quad (13)$$

$$= V_{ibrt}(X_{brt}, p_{brt}, I_{ibt}) + \epsilon_{ibrt}$$

where $V_{ibrt}(X_{brt}, p_{brt}, I_{ibt})$ represents the deterministic part of utility and ϵ_{ibrt} represents the unobserved factors that affect household's utility of purchasing. To take into account that households differ in unobserved preferences for the several brand-retailer combinations, we include γ_{irb}, which denotes household i's valuation for brand b at a retailer r.

The variables I_{ibt} and H_{irt} are two loyalty variables. First, I_{ibt} denotes a dynamic brand loyalty variable, suggested by Guadagni and Little (2008) and specified as:

$$I_{ibt} = \lambda I_{ibt-1} + (1 - \lambda) LastPurchase_{ibt} \quad (14)$$

[23] We didn't include transportation cost which is households' cost for travelling from one store to another due to data unavailability. However, such transportation cost argument is less appealing when the analysis is conducted at the national level of the national retail chains (Draganska et. al 2010).

[24] For some households in certain weeks, multiple purchases within a week are observed (either to same retailer or to different retailers), which is the case for 36% of the observed weekly shopping trips. However, these multiple purchases are category specific (either the shopper buys the different brands from the same retailer (29%) or from different retailers (7%)). For the first case, we construct a variable called *first choice brand* which is based on the households' previous brand choices. For the latter, we construct a variable called *first choice retailer* where a household spent the most in a given month. Then, for our analysis we select the first choice of brand or retailer.

where $LastPurchase_{ibt}$ is a dummy variable equal to 1 when brand b[25] was last purchased, and 0 otherwise, λ is a smoothing constant between 0 and 1[26] (see Melis et al. 2015 for a similar practice). Hence, the parameter ω_i captures a household's "loyalty" or "switching cost" of moving from one brand to another (Gordon et al. 2013; Guadagni and Little 2008). Second, H_{irt} denotes the retail loyalty variable, which is operationalized as share of wallet. It represents the monthly expenditure spent at a given retailer relative the total expenditure of the household across all retailers during that month. This has been considered as a proxy for retailer loyalty (Dubois and Jodar-Rosell 2010).

Furthermore, p_{brt} is the average price paid across all households for brand b in a retailer r at week *t*, converted in real terms using the yearly UK consumer price index obtained from the Office for National Statistics in the UK, and α_i is a household-specific valuation of price. To capture consumer heterogeneity in price response, we consider a specification that allows for both *observed and unobserved household heterogeneity*. We assume that the price coefficient α_i varies across households according to

$$\alpha_i = \alpha^0 + \sum_h \alpha^h HHchar_{hi} + \alpha^\sigma \nu_i^r \qquad \nu_i \sim N(0,1) \tag{15}$$

where α^0 is the mean responsiveness to the price, common across households. To account for observed heterogeneity, we interact price with the observed household characteristics $HHchar_{hi}$. Based prior literature and data availability, we include the following observed household

[25] Here for the brand loyalty, we didn't specify NBs differently for each retailer. Hence, we define loyalty as to brand itself not brand-retailer combination. For instance, households' loyalty to Kellogg's brand but not Kellogg's in Sainsbury's. For PLs, we specify loyalty as brand-retailer combination since PLs are specific to retailers and not available in other retailers.

[26] In line with prior research (Spotts 2014 and Gupta 1988), the smoothing constant is set equal to 0.7. Still, the same substantive findings are obtained for alternative smoothing constants (0.6, 0.75 and 0.87).

characteristics: *Number of Children*$_i$, *Social Class*$_i$ (i.e. lower versus middle versus upper) and *Share of Wallet*$_i$. To account for unobserved heterogeneity for price, we use a random coefficient specification (Chintagunta et al. 2002). Here, α^{σ} is the standard deviation around the mean valuation of price and υ_i is a random draw from the standard normal distribution, capturing unobserved household heterogeneity regarding price[27].

The assortment variable A_{jt} quantifies the number of SKU's available for brand b at retailer r, and β_i captures a household i's valuation with respect to the assortment variable. We also allow for heterogeneity for the assortment variable, assuming that the effect of assortment depth differs among the households.

$$\beta_i = \beta^0 + \beta^{\sigma} v_i^r \qquad v_i \sim N(0,1) \tag{16}$$

Finally, ϵ_{ibrt} is a household i specific valuation for brand b at retailer r in week t i.e. the "logit error term". It is identically and independently distributed according to the Type I extreme value distribution.

The outside good option where the $(J+1)th$ alternative indexed by $b = r = 0$ refers to a household's option to purchase a composite outside brand-retailer combination formed as the collection of other retailers' brands in the category. It has a normalized utility of $U_{i00t} = \epsilon_{i00t}$.

[27] In the special case where $\alpha^{\sigma} = 0$, there is no unobserved heterogeneity and we would obtain the conditional logit model.

Estimation

We specify the probability Pr_{brt} that household i chooses brand b in retailer r as follows

$$Pr_{brt} = \int \frac{\exp(\gamma_{irb} + \omega_i I_{ibrt} + \varphi_i H_{irt} - \alpha_i p_{brt} + \beta_i A_{brt})}{1 + \sum_{k=1}^{B} \sum_{s=1}^{R} \exp(\gamma_{iks} + \omega_i I_{ikt} + \varphi_i H_{ist} - \alpha_i p_{kst} + \beta_i A_{kst})} f(\theta) d\theta \quad (17)$$

with $f(\theta)$ the normal density function of the random coefficients θ. θ includes price coefficient α_i, assortment coefficient β_i and outside good dummy coefficient γ_{i0}. Given the size of our data set, where 24,963 households choose between 48 options in the canned soup category and 29,716 households choose between 50 options in the cereal category over the two years, we select a random subsample of 10% of the households in the canned soup category and 10% in the cereal category (see Chintagunta (1993) for a similar practice). That leaves us 2,496 and 2,971 households for soup and cereal categories respectively. We estimate the model with maximum likelihood and assume that the coefficients are drawn from a normal density function $f(\theta)$ to generate 100 draws of the coefficients for each household in line with Train (2003).

Own- and Cross-price Elasticities

Since we are mainly interested in the substitution pattern between product groups and not between individual products, we calculate product group-level price elasticities for all PL and NB groups that are sold in traditional retailers and discounters (i.e. economy PL, standard PL, premium PL, NB at traditional retailers, discounter PL and NB at discounters) (see Grzybowski et al. (2014) for an in-depth discussion). More specifically, a group-level elasticity is the percentage change in demand for a group of products in response to a 1% change in the price of all products in this group. To calculate the own group-level price elasticity, we proceed as follows. For the ease of exposition, we drop time *t*. The aggregate market share for product j in the same group δ_1 (e.g.

economy PL *1*, economy PL *2*) is defined as $s_{\delta_1} \equiv \sum_i \sum_{j\in\delta_1} s_{ij}/N$, where N is the number of households. Then the group-level own price elasticity of demand for the product in group δ_1 with respect to the price increase of all products in a same group δ_1 may be defined as:

$$\varepsilon_{\delta_1\delta_1} = \frac{\sum_i(-\alpha_i)\left[\sum_{j\in\delta_1} s_{ij}p_{ij}(1-\sum_{j\in\delta_1} s_{ij})\right]}{\sum_i \sum_{j\in\delta_1} s_{ij}} \quad (18)$$

Similarly, to calculate the group level cross-price elasticity, we define $j = 1 \ldots J$ products in group δ_1 and *k*=1…..*K* products in group δ_2. Then the group-level cross-price elasticity of demand for the group of products δ_1 with respect to the price increase of all products in group δ_2 may be defined as the following:

$$\varepsilon_{\delta_1\delta_2} = \frac{\sum_i(-\alpha_i)\left[(\sum_{j\in\delta_1} s_{ij})(\sum_{k\in\delta_2} s_{ik}p_{ik})\right]}{\sum_i \sum_{j\in\delta_1} s_{ij}} \quad (19)$$

3.4 Empirical Results

Table 3-3 presents the estimates for the canned soup and cereal category. Overall, we find that the results generalize reasonably well for both categories. The negative price coefficient (soup: -895.5; p<.01 and cereal: -751.2; p<.01), indicates that households are overall price sensitive. The interactions with household characteristics indicate that there is significant observed heterogeneity. Besides this observed consumer heterogeneity in price sensitivity, there is also significant unobserved heterogeneity regarding the valuation of price (soup: SD=671.0; p<.01 and cereal: SD=416.2; p<.01), as has also been reported in previous literature (Chintagunta et al. 2002; Meza and Sudhir 2010). Moreover, there is significant unobserved heterogeneity for the valuation of assortment among consumers (soup: SD=0.011; p<.01 and cereal: SD=0.014; p<.01). Also, the positive and significant mean effects of assortment is consistent with the idea that the service level

of a retailer increases consumer willingness to pay (soup: 0.029; p<.01 and cereal: 0.013; p<.01) (Draganska et al. 2010). We find that the impact of assortment size is not significantly different at discounters than at retailers in the soup category. In contrast, in the cereal category the impact of assortment size is significantly lower at discounters (-0.03; p<0.1). This finding is consistent with the recent literature on variety. It has been documented that an increase in variety is not always appreciated by consumers (Mantrala et al. 2009). Especially consumers who shop at discounters find the shopping process easy since there are not many products to choose from (Kumar and Steenkamp 2007). However, assortment depth of NBs in discounters positively affects the demand (soup: 0.22; p<.01 and cereal: 0.73; p<.01). This means that assortment size at discounters is even more important for the NBs compared to its PLs, and PLs/NBs at traditional retailers and with the increased variety in NBs, consumers find a product that matches their preferences and in general, variety seeking consumers are better served (Lin et al. 2012).

The significant positive brand loyalty coefficient (soup: 6.47; p<.01 and cereal: 6.34; p<.01) reveals state dependence, which implies that a brand has a higher probability of being purchased if it has been bought on previous purchase occasions, supporting the prior work (Geyskens et al. 2010 and Pauwels et al. 2002). Similarly, retailer loyalty has a positive and significant effect on demand (soup: 6.11; p<.01 and cereal: 5.67; p<.01).

Finally, the random coefficient on the outside good reflects consumer heterogeneity regarding the valuation of the inside goods relative to the outside good (soup: SD=1.97; p<.01 and cereal: SD=2.41; p<.01). On average, the significant random coefficient for the outside good dummy variable indicates that substitution between inside goods (selected traditional retailers and

Table 3-3 Estimation Results

			Interactions with household characteristics				
Variables	**Mean**	**Std. dev.**	**# children**	**Low class**	**Middle class**	**Retail Loyalty**	**Brand Loyalty**
Canned Soup Category							
Price	-895.5***	671.0***	-93.28***	-295.2***	-6.187	689.0***	-24.11
	(115.9)	(33.15)	(25.48)	(86.90)	(72.75)	(74.44)	(133.6)
Assortment	0.0291***	0.0118***					
	(0.00328)	(0.00148)					
Outside Good	3.557***	1.973***					
	(0.193)	(0.0689)					
Brand Loyalty	6.477***						
	(0.248)						
Retail Loyalty	6.119***						
	(0.142)						
Assortment* Discounter	0.00772						
	(0.0238)						
Assortment*NB *Discounter	0.221***						
	(0.0726)						
Brand Dummies	***Yes***						
Log Likelihood	-23178		**# of obs.**	**902,900**			
Cereal Category							
Price	-751.2***	416.2***	38.23***	-35.45	-37.42	405.2***	-151.6***
	(38.30)	(12.99)	(11.23)	(36.87)	(32.43)	(27.67)	(47.30)
Assortment	0.0135***	0.0146***					
	(0.00432)	(0.000787)					
Outside Good	1.943***	2.417***					
	(0.187)	(0.0720)					
Brand Loyalty	6.345***						
	(0.167)						
Retail Loyalty	5.675***						
	(0.125)						
Assortment* Discounter	-0.0345*						
	(0.0267)						
Assortment*NB *Discounter	0.727***						
	(0.267)						
Brand Dummies	***Yes***						
Log Likelihood	-47847		**# of obs.**	3,012,324			

*** p<0.01, ** p<0.05, * p<0.1 Note: The parameter estimates and standard errors (in parentheses) of the mean effects are shown in the second column. Column 3 shows estimates of the random coefficients, while columns 4-7 show estimates of the interaction effects between price and household characteristics.

discounters) is stronger than substitution towards the outside good (remaining small retailers' offerings and other formats (e.g. home delivery) (soup: 3.55; p<.01 and cereal: 1.94; p<.01) [28].

To obtain insights into brand switching pattern across retailers, we present the derived own-price and cross-price elasticities at the product group level for each retail format in Table 3-4 and Table 3-5. To make the tables clear, we divided the tables into four panels. Panel (i) indicates the switching pattern within traditional retailers. Similarly, panel (iv) indicates the switching pattern within discounters' offerings. Panel (ii) and (iii) show the cross-elasticities between traditional retailers and discounters.

All group-level *own-price elasticities* are negative. For instance, in Table 3-4, the own-price elasticity for standard PL in the soup category of -0.77 indicates that a 1% price increase for all standard PL products of traditional retailers reduces the demand for these alternatives by 0.77%. The own-price elasticities range from -0.36 (-0.61) for economy PLs to -1.36 (-1.95) for premium PLs of traditional retailers in the soup (cereal) category. For discounters, this range is from -0.33 (-0.53) for discounter PLs to -1.02 (-2.65) for NBs in the soup (cereal) category. Moreover, the cross-elasticity patterns between traditional retailers' offerings and discounters' offerings reveal already some interesting takeaways to understand the competition between PL and NB tiers. As indicated in Table 3-4 and Table 3-5, the cross-price elasticities are small but non-zero (between traditional retailers and discounters). This is in line with recent empirical evidence that there is retail format competition (see, e.g., Hartmann and Nair 2007 and Draganska et. al. (2010)). The

[28] To check the consumer heterogeneity among the valuation of the product groups (e.g. economy PLs, standard PLs,..), product group dummies were interacted with households characteristics. Since these did not appear to be significant, they are not included in the main model specification.

first important observation is that price changes affect demand mainly within retail formats, hence there is limited substitution from traditional retailers to discounters (panel ii) and vice versa (panel iii).

Moreover, when we look at the individual product groups within panels, a first interesting observation is that if the prices of NBs in traditional retailers are increased with 1%, consumer both stay in traditional retailer format and switch to all available PL options 0.71 (0.55) economy.

Table 3-4 Aggregate level own- and cross-price elasticity matrix for the Canned Soup category

		Traditional				***Discounter***	
		Economy PL	**Standard PL**	**Premium PL**	**NB**	**Discounter PL**	**NB**
			(i)			**(ii)**	
Traditional	**Economy PL**	-0.36	0.02	0.03	0.01	0.004	0.002
	Standard PL	0.17	-0.77	0.19	0.08	0.03	0.02
	Premium PL	0.03	0.02	-1.36	0.01	0.004	0.002
	NB	0.71	0.64	0.76	-0.42	0.10	0.52
			(iii)			**(iv)**	
Discounter	**Discounter PL**	0.01	0.01	0.01	0.01	-0.33	0.22
	NB	0.001	0.001	0.001	0.004	0.04	-1.02

Note: The table reports the percentage change in demand for groups (columns), due to % changes in prices of groups (rows).

Table 3-5 Aggregate level own- and cross-price elasticity matrix for the Cereal category

		Traditional				***Discounter***	
		Economy PL	**Standard PL**	**Premium PL**	**NB**	**Discounter PL**	**NB**
			(i)			**(ii)**	
Traditional	**Economy PL**	-0.61	0.01	0.02	0.01	0.01	0.01
	Standard PL	0.29	-0.85	0.35	0.25	0.08	0.10
	Premium PL	0.003	0.003	-1.95	0.002	0.001	0.001
	NB	0.55	0.40	0.65	-1.50	0.14	0.60
			(iii)			**(iv)**	
Discounter	**Discounter PL**	0.03	0.02	0.03	0.02	-0.53	0.58
	NB	0.00	0.00	0.001	0.001	0.02	-2.65

Note: The table reports the percentage change in demand for groups (columns), due to % changes in prices of groups (rows).

PLs, 0.64 (0.40) standard PLs and 0.76 (0.65) premium PLs and also switch to discounters' NB options 0.52 (0.60) in soup (cereal) category. Moreover, if the price of NBs in discounters are

increased, consumers mainly stay in the discounter format and switch to discounters' PLs (0.04 in soup and 0.02 in cereal). However, there is limited substitution takes place towards traditional retailers' NBs (0.004 in soup and 0.001 in cereal) and PL tiers (0.001 in soup and cereal).

Furthermore, since one of our main interest to shed some light on the effectives of economy versus standard PL versus premium PL tiers of traditional retailers to compete with discounters' PLs, it is interesting to look at cross-price elasticities between these tiers and discounters' PLs. Cross-price effect of standard PLs with respect to discounters' PLs is (0.03 in soup and 0.08 in cereal) bigger than the cross-price effect of economy and premium PLs w.r.t discounters' PLs (0.004 for economy and premium PLs in soup category and 0.01 and 0.001 for economy and premium PLs in cereal category). This indicates that standard PLs of traditional retailers mainly compete with discounters' PLs. In addition, if the price of discounters' PLs are increased, consumers mainly stay in discounters and switch to NBs (0.22 in soup and 0.58 in cereal) and partially switch to PLs and NBs of traditional retailers (0.01 in soup and 0.02 in cereal).

In sum, these findings on cross-price elasticities already give some insights on the inter tier competition across traditional retailers and discounters. We will explore this in much more detail in our counterfactuals in the next section by using not only price but full model estimates.

3.5 Counterfactuals

We can use the results of the demand model to simulate the impact of alternative scenarios on both traditional retailers and discounters. Our way of tackling this question is as follows. First thanks to our "*dropping*" scenarios (e.g. dropping economy PLs, dropping standard PLs, dropping premium PLs and dropping discounter PLs), we aim to identify "*who competes with whom*". Although, these scenarios sound extreme, it allows us to get a better grip on the competition. As a

follow up, we test the effectiveness of more realistic counterfactuals that are listed in business press for both parties (i.e. discounters and traditional retailers), namely setting more competitive prices for standard PLs and/or NBs in traditional retailers and increasing the assortment size in discounters to provide possible strategies to further grow in this competitive environment.

In Table 3-6 and Table 3-7, we first present the random coefficient logit model's predicted percentage market shares of the groups if there is no change in strategy as a benchmark setting (first row). For instance, in the canned soup category the predicted market share is 72.4% for all traditional retailers and 6% for the discounters. The remaining 21.6% is captured by the outside good. We will now compare this with the outcomes of several counterfactuals. We express these as percentage point changes relative the random coefficient logit model predicted choice shares (benchmark setting).

(i) Which PL tier competes with the discounters?

First, we present the predicted changes in the market shares after ***dropping the economy PLs*** from traditional retailers' assortment for the canned soup and cereal category. Total demand of traditional retailers would decrease by 2.1 and 1.2 percentage points for soup and cereal respectively, and discounters would increase their market share by 0.1 percentage points. To disentangle which product groups win or lose, we also decompose the total change in demand for traditional and discounters by looking at NBs and each PL tier. Table 3-6 and Table 3-7 show that the market share of standard PLs in traditional retailers mainly increases (+0.9 percentage points) for soup and cereal after the elimination of economy PLs. Moreover, dropping economy PLs leads a demand shift to NBs of traditional retailers (+0.1 percentage points for soup and cereal) and also discounters' own brands (+0.1 percentage point). This result is consistent with the findings of

Vroegrijk et al. (2016). They find that economy PLs might help the traditional retailers to preserve share-of-wallet among its loyal customers, and even enhance overall category sales in the competition with regular supermarkets, although they are not a particularly good defensive tool against discounters. Second, we present the changes in market shares after ***dropping the standard PLs*** from traditional retailers' assortment. Results show that standard PLs mainly compete with NBs of traditional retailers (+5.4 and +15.0 percentage points) increase in NB shares for the soup and cereal category. However, they also compete with economy PLs (+1.2 and +1.3 percentage points) and discounters' PLs (+0.3 and +1.1 percentage points) in respectively the soup and cereal category. The latter is a big increase knowing that the discounter PLs only have 6% market share on average in both categories. Moreover, ***dropping the premium PLs*** scenario shows that consumers of the traditional retailers stay within the traditional format for the soup (cereal) category and switch almost equally to economy PL tier, i.e. with 0.2 (0.05) percentage points, and standard PL tier, i.e. with 0.3 (0.03) percentage points) and also NBs, i.e. with 0.4 (0.04) percentage points. However, discounters' PLs still manage to steal a limited part of premium PL market share (i.e. 0.002 and 0.003 percentage points in the soup and cereal category respectively).

Finally, ***dropping the discounter PLs*** scenario reveals that consumers either mainly stay in the discounters and purchase available NBs, i.e. with 1.0 (0.4) percentage points or switch to traditional retailers' standard PLs, i.e. with 0.3 (1.6) percentage points for the soup (cereal) category. Hence, these findings indicate that especially the standard PLs who are able to steal market share from the discounters, followed by the economy PLs. The competition between the premium PL tier and the discounters' PLs is very limited.

Table 3-6 Different scenarios for the canned soup category

	Traditional Retailers					*Discounters*		
	Economy PLs	***Standard PLs***	***Premium PLs***	***NBs***	***Total***	***Discounter PL***	***NBs***	***Total***
Choice shares (benchmark setting)	3.20%	10.90%	1.10%	57.20%	**72.40%**	5.40%	0.60%	**6.00%**
Traditional Retailers' Scenarios:								
Drop economy PLs	(-)3.2	(+)0.9	(+)0.1	(+)0.1	**(-)2.1**	(+)0.1	(+)0.0	**(+)0.1**
Drop standard PLs	(+)1.2	(-)10.9	(+)0.3	(+)5.4	**(-)3.9**	(+)0.3	(+)0.0	**(+)0.3**
Drop premium PLs	(+)0.2	(+)0.3	(-)1.1	(+)0.4	**(-)0.2**	(+)0.02	(+)0.0	**(+)0.02**
Decrease standard PL price by 20%	(-)0.2	(+)1.7	(-)0.0	(-)0.9	**(+)0.6**	(-)0.0	(+)0.0	**(-)0.0**
Decrease standard PL price by 30%	(-)0.3	(+)2.6	(-)0.1	(-)1.5	**(+)0.7**	(-)0.1	(+)0.0	**(-)0.1**
Decrease NB prices by 15%	(-)0.4	(-)1.0	(-)0.1	(+)2.8	**(+)1.3**	(-)0.1	(+)0.0	**(-)0.1**
Discounters' Scenarios:								
Increase assortment size of NBs	(+)0.0	(+)0.0	(+)0.0	(-)0.2	**(-)0.2**	(-)0.1	(+)0.3	**(+)0.2**
Decrease discounter PL price by 20%	(-)0.05	(-)0.1	(-)0.0	(-)0.05	**(-)0.2**	(+)1.0	(-)0.2	**(+)0.8**
Decrease discounter PL price by 30%	(-)0.06	(-)0.15	(-)0.0	(-)0.06	**(-)0.3**	(+)1.2	(-)0.3	**(+)0.9**
Drop discounters PLs	(+)0.1	(+)0.3	(+)0.0	(+)0.1	**(+)0.5**	(-)5.4	(+)1.0	**(-)4.4**

(ii) Should traditional retailers adjust the pricing of their PLs and NBs?

On the one hand, one way for traditional retailers to fight discounters might be establishing ***more competitive prices for their standard PLs*** (Ailawadi et al. 2010; Gielens et al. 2008). In practice, this action is already seen. ASDA and Morrisons, the UK's 'Big Four' supermarkets with the largest overlap with hard discounters, have reacted by announcing a further round of price cuts (Reuters 2014). To test this, we consider the effect of adjustments in the price of standard PLs by decreasing its price by 20% (30%). These price drops result in a demand increase for standard PLs (i.e. respectively +1.7 (+2.6) percentage points for soup and +3.9 (+5.9) percentage points for cereal), mainly at the expense of NBs -0.9 (-1.5) for soup and -2.4 (-3.7) for cereal and almost no effect for premium PLs in both categories sold at the traditional retailers. However, this strategy helps

traditional retailers to steal some share from discounters (-0.1 percentage points on average for soup and -0.25 percentage points for the cereal category).

Table 3-7 Different scenarios for the cereal category

	Traditional Retailers					***Discounters***		
	Economy PLs	***Standard PLs***	***Premium PLs***	***NBs***	***Total***	***Discounter PL***	***NBs***	***Total***
Choice shares (benchmark setting)	2.23%	23.73%	0.09%	46.66%	**72.71%**	6.71%	0.04%	**6.75%**
Traditional Retailers' Scenarios:								
Drop economy PLs	(-)2.2	(+)0.9	(+)0.01	(+)0.1	**(-)1.2**	(+)0.1	(+)0.0	**(+)0.1**
Drop standard PLs	(+)1.3	(-)23.7	(+)0.1	(+)15.0	**(-)7.3**	(+)1.1	(+)0.0	**(+)1.1**
Drop premium PLs	(+)0.05	(+)0.03	(-)0.09	(+)0.04	**(-)0.03**	(+)0.03	(+)0.0	**(+)0.03**
Decrease standard PL price by 20%	(-)0.2	(+)3.9	(-)0.01	(-)2.4	**(+)1.2**	(-)0.2	(-)0.0	**(-)0.2**
Decrease standard PL price by 30%	(-)0.3	(+)5.9	(-)0.01	(-)3.7	**(+)1.9**	(-)0.3	(-)0.0	**(-)0.3**
Decrease NB prices by 15%	(-)0.4	(-)2.8	(-)0.02	(+)5.3	**(+)2.1**	(-)0.3	(-)0.01	**(-)0.31**
Discounters' Scenarios:								
Increase assortment size of NBs	(-)0.0	(-)0.0	(-)0.0	(-)0.0	**(-)0.0**	(-)0.0	(+)0.0	**(+)0.0**
Decrease discounter PL price by 20%	(-)0.1	(-)0.8	(-)0.0	(-)0.5	**(-)1.4**	(+)1.2	(-)0.08	**(+)1.1**
Decrease discounter PL price by 30%	(-)0.2	(-)1.0	(-)0.0	(-)0.7	**(-)1.9**	(+)1.6	(-)0.1	**(+)1.5**
Drop discounters PLs	(+)0.3	(+)1.6	(+)0.01	(+)1.0	**(+)2.9**	(-)6.7	(+)0.4	**(-)6.3**

On the other hand, traditional retailers might offer ***price cuts for their NB*** offerings instead of decreasing the price of standard PLs to fight the discounters. For instance, Tesco recently announced that they will fight back against the growth of discount supermarkets by cutting the price of hundreds of branded products including Hovis bread, Kellogg's cornflakes and some other NBs (Reuters 2015). The company said that the average reduction of about 380 branded products would be around 25%. To test this, we use an illustrative example by conducting a 15% price cut for NBs. We find that this action negatively affects discounters' PLs (-0.1 percentage point for

soup and -0.3 percentage points for cereal) and leads a demand increase for traditional retailers' NBs (+2.8 percentage points for soup and +5.3 percentage points for cereal), however their economy and standard PLs also lose market share (-0.4 and -1.0 percentage points for soup and -0.4 and -2.8 percentage points for cereal). We didn't use 20% and 30% price cuts for the NBs since these price cuts would make the NBs cheaper than the standard PLs which is never the case in the market. The chosen 15% price cut closes the gap between NBs and premium PLs while keeping the NBs still more expensive than standard PLs.

An important observation is that 30% price cut for standard PLs and 15% price cut for NBs affects discounters' share almost in a same way in terms of magnitude, however, these price cuts also lead cannibalization and stealing market share effect within traditional retailers. If we compare the net demand effect of these actions for the traditional retailers, it seems that cutting NB prices can be more preferable since the net market share effect of this action (1.4 and 2.1 percentage points) outweigh the net market share effect of standard PL price cut (0.7 and 1.9 percentage points) for the soup and cereal category respectively.

(iii) Should discounters adjust the price of their own PLs?

One way for discounters to steal market share from traditional retailers is to ***adjust their PLs' prices*** (The Telegraph 2016). In the current setting, they set the price of their own brands less than (but very close to) standard PLs and more than economy PLs of the traditional retailers. By conducting 20% and 30% price cuts for the discounters' own PLs, we make their price closer to economy PLs. Results show that these price drops result in a demand increase for discounter PLs (i.e. respectively +1.0 (+1.2) percentage points for soup and +1.2 (+1.6) percentage points for cereal), mainly at the expense of their NBs of -0.2 (-0.3) for soup and -0.08 (-0.1) for cereal and

standard PLs at the traditional retailers -0.1 (-0.15) for soup and -0.8 (-0.1) for cereal. In the end, this strategy helps discounters to steal some share from traditional retailers (-0.25 percentage points on average for soup and -1.6 percentage points for the cereal category).

(iv) Should discounters expand the NB presence in their stores?

Although discounters focus on minimal assortment, relying on their PLs and competitive prices compared to traditional retailers, they have realized that growth strategies based on prices makes them vulnerable to incoming discounters as well as traditional retailers. Due to this realization, discounters are ***increasingly introducing NBs in their assortments***. Recently, Aldi announced that they are further expanding the NBs of various manufacturers (Bord Bia 2016). This creates even more direct competition with traditional retailers and their main competitor Lidl, which successfully lists both branded and private label products. On the other hand, manufacturers use this opportunity to alleviate their independency on traditional retailers, who have developed their PL tiers (Ailawadi et. al. 2008, Lourenco and Gijsbrechts 2013). Hence, encouraging discounters to carry more manufacturer brands and deeper assortments may be an effective way to keep traditional retailers' PLs at bay (Dhar and Hoch 1997). This in turn, creates a win-win situation for both discounters and brand manufacturers at the expense of traditional retailers (Deleersnyder et. al. 2007). In our data, we already observe the presence of one or two leading NBs in both categories. However, discounters sell them on a temporary base or the assortment depth of the existing NBs is quite limited. For example, although consumers find Kellogg's cereals in the shelves of both discounters and traditional retailers, the available alternatives (e.g. Kellogg's Special K or Kellogg's Choco Pops) for Kellogg's are very limited in discounters compared to traditional retailers. Hence, it is a highly relevant question to test the possible increase in the

assortment depth of the NBs in discounters on the market shares of the traditional retailers and discounters. To test the effect of this action on market shares of the incumbent players, we hypothetically increase the number of available SKUs (assortment depth) for the available NBs in discounters with two[29]. Our findings reveal that this especially benefits the discounters' market share at the expense of the NBs in the traditional retailers. The market share of NBs in traditional retailers decrease 0.2 percentage points in the soup category and 0.0004 percentage points in the cereal category. The latter is extremely low which is strongly driven by the fact that cereal NBs are hardly ever bought in this category, probably due to the low availability together with the relatively high price compared to the same brand at the traditional retailers.

3.6 Discussion

In this study, we have analysed the impact of PL tiers on the competition between traditional retailers and discounters. We estimated two random coefficient logit models for the choices in respectively the canned soup and cereal category. The adopted model allows for unobserved heterogeneity regarding the valuations of alternatives (inside good versus outside good) and regarding the sensitivity to assortment and price, which implies richer substitution pattern.

Our main substantive findings are as follows. First, thanks to our "*dropping*" scenarios (e.g. dropping economy PLs, dropping standard PLs, dropping premium PLs and dropping discounter PLs), we aim to identify "*who competes with whom*". In particular, we compare the effectiveness of three PLs offered by traditional retailers compete with discounters: standard PLs

[29] For example, Aldi offers Kellogg's brand but the variety of the offerings within Kellogg's is limited. The current assortment only consists of 3 Kellogg's offerings (3SKUs). We then hypothetically introduce two new SKUs (e.g. Kellogg's Special K or Kellogg's Choco Pops) by increasing the assortment from 3 to 5.

versus premium PLs versus economy PLs. Especially the latter is specifically designed to fight with discounters (Global Retail Mag 2014). We find that premium PLs do not seem an effective strategy in this fight. They mainly cannibalize the traditional retailers' standard PLs and steal market share from their NBs in both categories. On the other hand, although economy PLs manage to steal some market share from discounters, they mainly cannibalize standard PLs. Standard PLs seem the most effective strategy to fight discounters since they steal most market share from discounters. To reinforce this finding, we test this with a reverse strategy namely "*dropping discounter PLs*". Similarly, we find that the lost discounter PL share is absorbed by standard PLs of traditional retailers. Moreover, there is an ongoing discussion in the grocery retailing industry whether introducing economy PLs is really a right strategy to fight with discounters since in the end the net effect of this strategy for the retailer is a big question mark in terms of profitability. To test this, we obtained average margin data per product for the cereal category from AiMark together with the accompanying standard deviation (for a comparable retailer in the Dutch market)[30]. Results show that introducing economy PLs may erode the category profit by 0.6%. Hence, both demand and profit implications show that introducing economy PLs does not help traditional retailers in the fight with discounters since it fails to steal significant share from discounters, cannibalize own offerings as well as erode category profitability.

Secondly, we propose more realistic alternative policy changes for both parties (traditional versus discounter) which have been highly discussed in the business press. For traditional retailers, results reveal that (i) decreasing standard PL prices by 30% (ii) and decreasing NB prices by 15% affect the discounters' PLs in a similar way. Hence both options are effective tools to keep

[30] Knowing that retailers strongly differ in the adopted margins between categories and between brand types and quality tiers, we follow Hökelekli et al. (2017)'s approach where a set of sensitivity analyses are conducted given the observed standard deviation of each product.

discounters at bay. However, since these strategies also affect traditional retailers' own offerings (PL/NB), the net demand effect for traditional retailers is also important. Among these three options, implementing a price cut for NBs seems a more favourable option for traditional retailers, since the market share gain for NBs (3.7 percentage points in soup and 7.1 percentage points in cereal) offset the demand loss for all PL options (1.9 percentage points in soup and 4.2 percentage points in cereal). Furthermore, the profit implications (for the cereal category using the same margins discussed above) of these price cuts suggest that a retailer is worse off in terms of profitability by 32% if the prices of standard PLs are reduced by 30% in the cereal category. Similarly, decreasing NB prices by 15% leads to an even bigger decrease in the category profits by 45% in the cereal category. Generally speaking, the combined demand and profit implications can be interpreted as follows: fighting with discounters hurts traditional retailers' profits in the short run, but prevents discounters to further grow in the end (and so is likely to protects long term profits of the traditional retailers in that category but probably also other categories).

Thirdly, our findings indicate that increasing the assortment depth of the current available NBs, by offering more brand variants of the same brand, benefits discounters to gain market share, mainly at the expense of NB sales at the traditional retailers. Finally, offering price cuts for their own PLs benefit discounters at the expense of standard PLs of the traditional retailers.

Managerial Implications

Understanding how traditional retailers and discounters fight with each other is critical to both retailers (traditional versus discounters) and NB manufacturers. When discounters enter a local market, traditional retailers are severely affected and incur sales losses of approximately 17% on average (Ailawadi et al. 2010; Vroegrijk et al. 2013). For retailers, we challenge the common belief

that introducing economy PLs is the most appealing strategy in response to such discounter threat (Vroegrijk et al. 2013). However, we show that negative effects can result from this strategy. Offering economy PLs can result in cannibalization (IPLC 2014). In addition to this, shopper surveys reveal that UK shoppers believe the quality of discounters' PLs are comparable to standard PLs of the traditional retailers (Just Food 2015). Indeed, our results show that discounters' PLs mainly compete with standard PLs of the traditional retailers. Thus, if traditional retailers want to mitigate the loss that is incurred due to discounters, they should mainly focus on their standard PL tier and its pricing strategies. But if economy PLs fail to compete with discounters which they were actually designed for, with whom do they then compete? To reveal some insights on this, we simply check the retailer-specific counterfactuals for the economy PL tier in the canned soup category. Table 3-8 in the appendix shows the switching pattern when the economy PL tier is dropped in one retailer. We find that economy PLs of traditional retailers actually compete more strongly with each other and as well as standard PLs instead of discounters. Hence, there is strong intra-tier competition across traditional retailers' economy PL alternatives and inter tier competition w.r.t standard PLs. This is in line with the findings of Vroegrijk et al. (2016), who find that even though economy PLs are not a particularly good defensive tool against discounters, they might be useful to withstand competition with other (possibly lower-priced options) traditional retailers.

We also believe that brand manufacturers can use the traditional retailers-discounters fight to their own benefit. On the one hand, they can team up with traditional retailers and allow to set more competitive prices for their NBs. We find that decreasing the price of NBs in traditional retailers can be a strategy to help both brand manufacturers and traditional retailers in terms of demand, hence creating a win-win situation. On the other hand, they can work with discounters

and increase their availability in discounter stores, which again benefits both them and the discounters.

3.7 Limitations and future research

Our research has several limitations that offer interesting avenues for future research. In this study, we analyze in detail two fast moving consumer goods categories. Although the selected categories differ in terms of PL concentration and purchase frequency among others, future research should extend the set of categories under investigation, to further generalize our findings and to reveal underlying category drivers of NB-PL competition both across and within traditional retailers and discounters. That would, in turn, allow researchers to understand how competition differs according to (i) the category's role for the retailer, (ii) the category's growth potential, and (iii) the NB's marketing conduct in the category. In addition, our findings are not necessarily generalizable to broader market contexts in which PLs are common, for instance clothing or home-ware.

Second, our data all come from one geographic market (national level), so we do not consider the location effect. In fact, being located close to traditional retailers for discounters can mitigate losses, since becoming part of a twin location with the discounters may turn the traditional supermarket into an attractive option for combined visits (Vroegrijk et al. 2013). Moreover, this strategy may result in a win-win situation for both traditional retailers and discounters, since it can create inter-store synergy and increase consumers' spending (Ailawadi et al. 2010; Singh, Hansen, and Blattberg 2006).

Third, from our findings we can assess the alternative strategy of fighting discounters as it was initiated 6 years ago by Tesco. Tesco introduced a "fourth" tier of discount brands that are

targeted to discounters' shoppers (Financial Times 2008). They price this new tier of brands between economy and standard PL offerings. According to Tesco, this strategy helped them to retain their customers (Planet Retail 2010). Indeed, we also find that this introduction can help traditional retailers to combat with discounters although it hurts traditional retailers' existing offerings when we only consider the price effects[31]. However, new products do not include the Tesco name, but carry own branded products like *All About Shine* and *Trattoria*. Our model does not include the effect of using "pseudo names" instead of "retailer name". Therefore, more research is needed to study this strategy.

Fourth, traditional retailers have recently been trying to find alternative ways to stop discounters' growth. Sainsbury's recently relaunched Netto as its own discount chain. "If you can't beat them, join them" (The Telegraph 2016). With this strategy, Sainsbury's tries to keep its image of antithesis of discounting, and it avoids to pollute its own Sainsbury's brand by not changing its price and still putting emphasis on quality. However, very recently Sainsbury's announced that it will stop its partnership with Netto. The jury is therefore still out on whether teaming up with discounters could help traditional retailers instead of fighting. It would be interesting to study this in future research.

Fifth, in-store and out-of-store promotional activities like display, feature and advertising, are likely to influence retailer and/or brand choice. Future research should extent the demand model with these potential drivers of consumer demand.

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[31] To test the effect of this action on market shares of the incumbent players, we hypothetically introduce this new fourth tier in each traditional retailers' assortment (e.g. Tesco discount brand, Asda discount brand, Tesco Extra discount brand, Sainsbury's discount brand and Morrison's discount brand). This results in 5 extra alternatives in consumers' choice set[31]. Hence, now consumers face with 53 brand-retailer combinations instead of 48 for the soup category and 55 brand-retailer combinations instead of 50 for the cereal category. We find that this introduction negatively affects economy PLs (0.3 percentage points), standard PLs (0.9 percentage points) and NBs (2.6 percentage points) of traditional retailers as well as discounters' PLs (0.1 percentage points) (results are not shown in table 7).

Finally, we do not consider the cross-category effects due to limited data. Stealing market share from discounters in one category might spillover to other categories – a topic that we leave for future study.

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Appendix

Table 3-8 Retailer-specific own- and cross-price elasticity matrix for canned soup category

	Traditional Retailers' Economy PLs					***Traditional Retailers' Standard PLs***					***Discounters' PLs***	
	Asda Economy PL	*Morrisons Economy PL*	*Sainsbury's Economy PL*	*Tesco Economy PL*	*TescoExtra Economy PL*	*Asda Standard PL*	*Morrisons Standard PL*	*Sainsbury's Standard PL*	Tesco Standard PL	*TescoExtra Standard PL*	*Aldi PL*	*Lidl PL*
Choice shares (benchmark setting)												
	1.10%	0.31%	0.94%	0.45%	0.36%	3.17%	1.04%	2.58%	2.46%	1.70%	2.51%	2.91%
Traditional Retailers' Scenarios:												
Drop Asda economy PLs	**(-)1.10**	(+)0.02	(+)0.06	(+)0.03	(+)0.03	**(+)0.30**	(+)0.0	(+)0.02	(+)0.05	(+)0.02	(+)0.01	(+)0.01
Drop Morrisons economy PLs	(+)0.06	**(-)0.31**	(+)0.05	(+)0.03	(+)0.03	(+)0.05	**(+)0.04**	(+)0.02	(+)0.04	(+)0.02	(+)0.01	(+)0.01
Drop Sainsbury's economy PLs	(+)0.06	(+)0.02	**(-)0.94**	(+)0.03	(+)0.03	(+)0.06	(+)0.0	**(+)0.23**	(+)0.05	(+)0.02	(+)0.01	(+)0.02
Drop Tesco economy PLs	(+)0.06	(+)0.02	(+)0.05	**(-)0.45**	(+)0.03	(+)0.05	(+)0.0	(+)0.02	**(+)0.14**	(+)0.02	(+)0.01	(+)0.01
Drop TescoExtra economy PLs	(+)0.06	(+)0.02	(+)0.05	(+)0.03	**(-)0.49**	(+)0.05	(+)0.0	(+)0.02	(+)0.02	**(+)0.20**	(+)0.01	(+)0.01
Discounters' Scenarios:												
Drop Aldi PL	(+)0.08	(+)0.03	(+)0.08	(+)0.04	(+)0.04	(+)0.09	(+)0.02	(+)0.07	(+)0.09	(+)0.06	**(-)2.51**	(+)0.09
Drop Lidl PL	(+)0.07	(+)0.03	(+)0.08	(+)0.04	(+)0.04	(+)0.09	(+)0.02	(+)0.06	(+)0.08	(+)0.05	(+)0.06	**(-)2.91**

Note: This table shows that if economy PLs of the individual retailers or discounter PLs is dropped, which products do attract the lost share. Choice shares (benchmark setting) are expressed as percentages. Outcomes of the counterfactuals are expressed as percentage point changes relative to the benchmark setting.

Chapter 4 Do Consumers Benefit from an Economy and Premium PL Introduction? Evidence from the U.K.

4.1 Introduction

The popularity of private labels (PLs) keeps growing in developed regions like Europe, North America and Australia (Nielsen 2014). Especially in Europe, PLs account for $1 of every $3 spent in the consumer-packaged goods (CPG) market. Switzerland has the highest PL share (in Europe and around the world) at 45%, followed closely by the U.K. and Spain at 41% each (Nielsen 2014). PLs play an important role in the European food retailing with their three-tier ('cheap', 'good' and 'better') form. Retailers are increasingly using them as a strategic tool to retain and expand customer demand, to improve the image, and to achieve a unique position (Haas and Weawer 2010). In fact, over the last decade, many retailers already introduced economy and premium PLs in their assortment next to the standard PL tier (PWC 2011). Economy PL introduction gained popularity among the traditional retailers particularly since retailers assume that economy PLs are a good defense mechanism against discounters (Vroegrijk et al. 2016). Retailers differentiate their economy PLs from the standard PL offerings by emphasizing their low price and acceptable-quality level (Dekimpe et al. 2011; Steenkamp and Kumar 2009). Similarly, retailers continuously introduce premium PL tiers which offer high quality products, and differentiate themselves from national brands (NBs). Retailers especially use them to engender store loyalty, and price them comparably with brand leaders (Ezrachi and Ahuya 2009; PLMA 2011).

The growing importance of the economy and premium PLs has recently been recognized as being of great managerial (S4RB 2016; IRI 2014; IPLS 2015) and also academic interest. Geyskens et al. (2010) investigate the sales effect of the introduction of economy and premium

PLs on incumbent brands. Vroegrijk et al. (2016) concentrate on the role of economy PLs on the retailers' fight with hard discounters. Keller et al. (2017) study the different brand name strategies of the economy PLs on the retailers' performance. Moreover, Ter Braak et al. (2014) study the category drivers of premium PL introduction. Gielens (2012) studies the impact of PL and NB introductions on category sales and the share of the top-3 NBs and the three PL tiers. Dawes and Nenycz-Thiel (2013) study the intensity of PL competition across retailers. Furthermore, Hökelekli et al. (2017) explore the impact of PL proliferation by looking at line extension/delisting, and its implications for consumer demand and profitability. Finally, Hökelekli et al. (2017) compare the effectiveness of three types of PLs (economy PLs versus standard PLs versus premium PLs) offered by traditional retailers to fight discounters. In short, all these studies investigate the drivers and performance (sales) implications of the economy and premium PLs either for retailer or manufacturer focus. In contrast to these previous studies, this paper aims to evaluate the effect of economy and premium PL introductions from a consumers' perspective. More specifically, the focus is the consumer welfare implications of the economy and premium PL introductions. Therefore, the main research questions are: How do a retailer's PL tier introductions (i.e. economy and premium PL) at traditional retailers affect consumer welfare? Do consumers benefit from being able to buy an additional PL tier at a retailer, or do retailers use the introduction of economy and premium PL tiers to raise the prices of their current PL offerings (i.e. standard PLs), and are they in the process making consumers worse off?

While popularity of PLs keeps growing, the past decade has seen growing antitrust concerns about the impact of PLs on consumer welfare and competition in the grocery sector (Daskalova 2012). In fact, competition authorities in Europe increasingly raise their concerns around the effect of recent PL tier introductions on consumer welfare. As retailers control the price

difference between their PLs and the NBs as a final seller, they therefore can manipulate the prices and the perceived value of goods, to benefit their PLs (Ezrachi and Ahuya 2009). For instance, in 2012, the leading Parisian supermarket Casino overpriced the NBs compared to other retailers, but priced its PLs competitively (Berasategi 2014). The French Competition Authority concluded that this practice restricts consumers' freedom of choice as well as market competition. In addition to NB pricing, retailers have full control over pricing of PLs. PLs differ in size, nature and quality between supermarket chains which makes it difficult for consumers to engage in price comparison. This reduced transparency tends to soften price competition between the PLs of different retail chains and eventually harms consumer welfare (UK Competition Commission Grocery Market Inquiry 2008). Hence, considering the competition authorities' welfare concerns and the recent calls for more consumer welfare-oriented research by industry observers (Hyman et al. 2010), this study aims to shed light on the effect of PL tier introductions on consumer welfare.

Consumer Welfare Effect of Economy and Premium PL Introductions

Consumers can be affected by new product introductions in two ways. First, they gain surplus through the impact of an additional variety that is offered by retailers which is called the '*variety effect*'. The degree of the variety effect depends on the possible substitution between the newly introduced brand and incumbent brands. For instance, if a new brand is closer to existing brands in retailer's assortment, then it will add less to consumer surplus (Hausman and Leonard 2002). Second, consumers' welfare can be affected through the impact of increased or reduced competition in the market which is called the '*price effect*'. This effect can be positive or negative depending on retailers' pre-and post-introduction market behaviour (Arnade et al. 2011). This setting is a specific situation where retailers have the final say over the prices of all products in the

market. In this case, if the retailer didn't have any PLs in the market, the introduction of a new PL tier increases competition, leading to lower prices and an increase in consumer surplus. However, if the retailer already serves the market through existing PLs, the retailer may increase the incumbent PL prices strategically, which would implicate a consumer welfare loss (Hausman and Leonard 2002). Therefore, the total consumer welfare effect depends on the relative strength of these forces. In this paper, since retailers have already been serving the market with their standard PL tier, the purpose is to analyse the net benefit of an economy and premium PL tier introduction for the consumers. The timing and the order of the new PL tier introductions are consistent across retailers in U.K. market. First, retailers introduced economy PLs next to their existing standard PL tier. Hence, this study analyses the impact of economy PL introduction on consumer welfare when the standard PLs and NBs are the incumbent products. Second, retailers followed the economy PL introduction with the introduction of premium PLs. Thus, the second welfare analysis is conducted for the premium PL at the backdrop of standard and economy PLs being well-established in the market.

Table 4-7 (see appendix) gives an overview of the previous literature on the impact of brand introductions on consumer welfare. Previous literature on consumer welfare focuses on either retailer entry or brand introductions at retailers. Hausman and Leibtag (2007) analyse the Wal-Mart entry and find that consumers not only benefit from the increased variety through the increased store choice but also enjoy the lower price of Wall-Mart. Hausman and Leonard (2002) study the impact of NBs at the retailers and find that consumers are better off due to increased variety as well as cheaper prices. Moreover, Lin et al. (2012) study the impact of NB introductions at hard discounters. They find that, in general, NB introductions are welfare enhancing which is mainly due to additional variety effect. Total welfare increases because consumers appreciate the

new NB variety in discounters' assortment which previously very limited due to their 'PL only focus'. Finally, Bonfrer and Chintagunta (2004) and Pauwels and Srinivasan (2004) study the welfare impact of PL introductions in retailers. The latter find that consumers benefit from lower prices through increased competition as well as enjoy more variety since NB manufacturers react PL introduction by introducing more product variants. However, both studies only focus on the middle tier which is standard PLs. However, this study focuses on the two other tiers which are economy and premium PLs, and aims to provide a complete picture of the effect of PL tier introductions on consumer welfare.

Price Effect

By changing the competitive structure of the industry, the new tier introduction can lead to either an increase or decrease in the prices of existing tiers/brands. For the economy PL introduction, the natural question is what will be the price effect of this introduction on retailer's existing tiers. Economic theory predicts that if the new tier competes closely with the existing tiers of the same manufacturer, the manufacturer may be able to raise the price of its existing brands (Hausman 1997). Hence, the retailer can increase the price of standard PLs. Similarly, the compromise effect predicts that as a result of the introduction of the economy PL, standard PLs will increase in utility and, therefore, their relative choice probability increases since they become a compromise or middle option in the assortment (see also Geyskens et al. 2010). In the end, standard PLs become more appealing for the consumers who are often uncertain about the product quality and have the tendency to choose the middle option (Geyskens et. al 2010; Wernerfelt 1995). Therefore, in this case, retailer can use economy PL introduction as an opportunity to increase the price of its existing standard PL tier.

On the other hand, an economy PL introduction at a retailer may also lead to a decrease in the prices of the incumbent standard PLs since this introduction creates increased inter-tier competition (e.g. Besanko and Braeutigam 2002). When the new tier takes away sales from the incumbent products, the retailer may react by decreasing the price of existing tiers (Lin et al. 2012). In this case, it would be expected that the prices of the standard PL offerings may drop. Furthermore, either brand manufacturer or retailer (as a final seller of NBs) can use the economy PL introduction to increase the prices of NBs. Thanks to introduction of a lower quality option (i.e. economy PL) in the retailer, NBs become a compromise or middle option in terms of quality in the retailer's assortment (Geyskens et al. 2010). Therefore, NBs can be even more appealing for the consumers who are ready to pay a price premium for a better-quality product.

For the premium PL introduction, the main question is what will be the price effect of this introduction on retailer's economy and standard PLs as well as NBs. A premium PL introduction can result in a price increase for the retailer's existing PL offerings. Premium PLs are more expensive than the standard and economy PLs of the retailers. Consumers generally remember higher prices and set their references accordingly (Steiner 1973; Kanetkar, Weinberg and Weiss 1992). Hence, retailers may use this consumer behaviour hint as an opportunity to raise the current PL prices. As a result, consumers are worse off since they have to pay higher prices for the incumbent PLs.

In contrast, economic theory predicts that this new tier increases the competition among PLs (Besanko and Braeutigam 2002). Since the premium PLs take away some sales from the existing brands, retailers may decrease the current tiers' prices (e.g. economy and standard PLs). Moreover, with this new three-tier PL offerings, retailers act more strategically and may try to segment their customers according to their price sensitivity (Bridge Strategy 2017). By lowering

their economy and/or standard PLs' prices they can target price conscious customers and with the new premium PL tier, they can target price insensitive customers. In addition to this, this strategy also benefits customers since they are able to buy the existing products at lower prices, thus enhancing consumer welfare.

In terms of the effect of premium PL introduction on NB prices**,** two effects are at play. The competition effect predicts that if a new tier competes more closely with certain products, the prices of these products are likely to fall. In this case, one can expect that sales of NBs will be affected most, as they are characterised by a similar quality, and by consequence it is likely NB manufacturers will react by lowering their prices. Previous empirical research indeed confirmed that the introduction of standard PL leads to lower NB prices (Chintagunta et al. 2002). The second effect is the brand image effect, which highlights the importance of the 'brand addiction' of consumers. Following the entry of a premium PL, the retailer or brand manufacturers may increase NB prices by emphasizing the "better quality NB image (Gabrielsen and Sørgard 2007).

Variety Effect

Most researchers agree that consumers prefer more variety when given a choice (Brynjolfsson et al. 2003; Kahn and Lehman 1991; Baumol and Ide 1956). Therefore, an additional PL tier in retailers' assortment would be appreciated by consumers. Moreover, these new introductions fill certain gaps in the market instead of copying or replacing NBs, e.g. offer acceptable basic quality at lower price (i.e. economy PLs) or innovative and better products at a comparable NB price (i.e. premium PLs). Consequently, the introductions may satisfy the consumer needs in a more convenient way and be welfare enhancing (Sorescu and Spanjol 2008). Finally, one would expect that the variety effect for the economy PL introduction is stronger than the premium PL

introduction. When an economy PL is introduced in a market where no similar products are available, the perceived variety is expected to increase considerably, since a new differentiating attribute is brought into play (Van Herpen and Pieters 2002). In this case, a new differentiating attribute is "lower quality-no frills product" which makes the economy PLs unique in the market. However, premium PLs do not fill a pre-existing quality gap in the market.

On the other hand, there is a large stream of research that shows 'more is not always better', stressing that consumers don't necessarily prefer more variety (Iyengar and Lepper 2000). When there is excess choice, consumers are more likely to buy nothing at all, and if they do buy, they are less satisfied with their selection (Harvard Business Review 2006). Moreover, more choice requires more time and effort to spend (i.e. search cost), hence eventually each new option can make consumers feel worse off than before. These new PL introductions may create choice overload in the eyes of consumers. Hence, consumer welfare can be worse off if they look for simplicity with a reasonable assortment.

To sum, an introduction of an economy and premium PL in retailers can be beneficial or detrimental for the consumers. Since the net consumer welfare effect depends on the relative strength of these effects, one needs to conduct a welfare analysis to find out the answer. The remainder of the paper is organized as follows. In the next section, I provide a description of the data and a brief overview of the industry. In section 4.3, I explain the proposed research method. Section 4.4 explains the empirical setting and the steps to calculate consumer welfare. Section 4.5 discusses the study's empirical results and finally in section 4.6, I conclude with a discussion and special attention for the limitations of my research.

4.2 Research Setting

To study the consumer welfare implications of the economy and premium PL introductions, the study uses the U.K. household panel data from Kantar Worldpanel[32]. This panel data consists of the purchase records of representative households that shop in the ready to eat cereal (RTE) and canned soup categories across all retailers. The data cover the period from January 1993 until July 1997 for the cereal category and from January 1998 until December 2002 for the soup category. The advantage of this data over other data sets used in consumer welfare studies, is that retailer level information is also readily available. Hence, change in consumer welfare due to the economy or premium PL introductions in U.K.'s top leading retailers can be separately analysed.

The UK retail market is one of the pioneers of PL tier introductions in Europe and PLs account 50% of the U.K. retailer sales, which makes it one of the highest in Europe (Nielsen, 2014). The U.K. market is dominated by four large retailers that account for around 75% of the total grocery market, whereas top five manufacturers only represent 10.8% of the market (PWC 2011). As a result of this high retail concentration and equally high market power, the market is fiercely competitive as each retailer develops its own unique point of difference by introducing PL tiers in an attempt to attract new customers and entice existing customers to spend more (Bord Bia, 2010).

I select the cereal category for the economy PL tier introduction, and the soup category for the premium PL introduction. The chosen categories give a good set-up for the welfare analysis since the timing of the introductions by the retailers are very close (see Table 4-1 and Table 4-2). Both categories enjoy high penetration of PL-tier introduction in the retailing markets. Secondly,

[32] The Kantar Worldpanel data was obtained through AiMark.

these categories are concentrated with leading NBs and other following PLs so that the competition between PLs and NBs are more strategic. Finally, manufacturers and retailers are competing with each other by introducing varieties of products in flavours, packaging, and even labelling strategies (Ying and Anders, 2013). Therefore, these categories are suitable to the analysis of consumer reaction of new brand introductions. Before the economy and premium PL tier introductions, retailers have been offering NBs as well as their standard PLs. In terms of PL tier introduction timing, retailers first introduced their economy PL options next to their standard PL offerings in early 90s in U.K. market. After that, they introduced their premium PL options at the beginning of 2000. For the economy PL introduction in the cereal category, Asda, Sainsbury's, Safeway and Somerfield are selected. For the premium PL introduction in the soup category, Asda, Sainsbury's and Safeway are selected since these retailers are the first ones to introduce the premium PL tier, with a similar timing of the introductions[33].

For the analysis[34], household level data on purchases are aggregated into weekly observations for each retailer. The retailer level data are the sum of individual household' quantities and expenditures for each brand[35]. For each retailer, top NBs are chosen based on their average market share which is above 0.5% cut off point, measured as a proportion of total purchases over sample period. All retailers have the same top existing brands that allows consistency for the analysis. In addition to NBs, for the economy PL introduction in the cereal category, standard PL is also included for the analysis as in that time no premium PL tier is introduced. Whereas for the premium PL introduction analysis in the soup category, in addition to

[33] Other big retailers (e.g. Tesco, Morrisons and Somerfield) introduced the premium PL tier in the soup category in 2007 (which is much later than the selected retailers' timing).
[34] The analysis was done by using the data in post introduction period.
[35] The SKU level data is aggregated to the brand level.

top NBs and standard PL tier, also economy PL tier is included since economy PL tier introduction happened much before the premium PL introduction across retailers. In the soup category, top NBs are Campbells, Heinz, Weight Watchers, Baxters while in the cereal category, top NBs are Alpen, Nestle, Kellogg's, Weetabix.

Table 4-1 Average value share of top existing brands and Economy PL in pre- and post-introduction periods (cereal)

Retailer	**Asda**		**Sainsbury's**		**Safeway**		**Somerfield**	
Period	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
	May 1995		**Sep 1995**		**Nov 1994**		**Jan 1995**	
Alpen	0.017	0.018	0.016	0.016	0.016	0.023	0.031	0.019
Nestle	0.077	0.114	0.094	0.139	0.104	0.129	0.118	0.117
Kellogg's	0.589	0.520	0.425	0.393	0.586	0.488	0.700	0.620
Weetabix	0.106	0.112	0.088	0.090	0.084	0.095	0.094	0.099
Standard PL	0.211	0.213	0.377	0.350	0.210	0.250	0.074	0.134
Economy PL	N. A.	0.023	N. A.	0.011	N. A.	0.015	N. A.	0.015
# of households	2484		3416		2094		811	

Table 4-2 Average value share of top existing brands and Premium PL in pre- and post-introduction periods (soup)

Retailer	**Asda**		**Sainsbury's**		**Safeway**	
Period	**Before**	**After**	**Before**	**After**	**Before**	**After**
	Jun-2001		**May-1999**		**Dec-2000**	
Alpen	0.100	0.064	0.125	0.121	0.137	0.14
Nestle	0.481	0.520	0.427	0.468	0.548	0.580
Kellogg's	0.038	0.062	0.046	0.049	0.053	0.065
Weetabix	0.059	0.085	0.102	0.095	0.105	0.096
Standard PL	0.258	0.219	0.286	0.191	0.133	0.101
Economy PL	0.063	0.047	0.015	0.026	0.024	0.012
Premium PL	N. A.	0.008	N. A.	0.052	N. A.	0.011
# of households	4152		3115		2783	

Table 4-1 and Table 4-2 present the number of unique households in the panel that shop in the selected retailers as well as the average value shares of the existing brands and the new PL tiers in the pre- and post-introduction periods for each category. The cumulative number of

households ranges from 811 (Somerfield) to 3416 (Sainsbury's) in the cereal category and from 2783 (Safeway) to 4152 (Asda) in the soup category. The value share of the existing brand ranges from 70% for Kellogg's in Safeway to 1.6% for Alpen in Sainsbury's in the cereal category and ranges from 58% for Heinz in Safeway to 1.2% for Economy PL in Safeway in the soup category.

4.3 Research Method

Since the objective is to quantify the change in consumer welfare due to economy or premium PL introduction, the monetary value of this change should be defined first. Compensating variation (hereafter CV) can be used to quantify the effect of an introduction on consumers' net welfare (Hausman and Leonard 2002; Arnade et al. 2011). CV is the difference in the consumers' expenditure with and without the economy and premium PL available, such that the consumer utility level remains unchanged. Utility is kept constant in the post introduction period as to isolate the change in welfare induced by the new PL tier introduction. In other words, CV is the change in welfare (expressed in consumers' expenditure) with and without the new PL tier available in retailer's assortment. It can be written as:

$$CV = \Delta\, in\ consumer\ welfare = \underbrace{E(p_i^0, p_{new}^*, \bar{u})}_{\text{without PL tier introduction}} - \underbrace{E(p_i^1, p_{new}, \bar{u})}_{\text{with PL tier introduction}} \quad (20)$$

where p_i^1 is the vector of incumbent brands' prices when the new PL tier is present. p_{new} is the price of the newly introduced PL tier at the retailer. p_i^0 is the price vector of incumbent brands when the new PL tier is absent, and p_{new}^* denotes the "virtual price" of the economy or premium PL at which demand for the economy or premium PL would be zero given the prices of the incumbents. In other words, the virtual price refers to the hypothetical price of economy or

premium PL that makes the demand zero as if this product doesn't exist. While the first term captures the virtual expenditures, the second term captures the actual expenditures when the new PL tier is present. Note that in both terms, consumer utility is held constant ($\bar{u}$) at post introduction level which allows us to capture the change in consumer welfare due to new PL tier introduction. This total change in consumer welfare can be separated into two parts: variety effect *(VE)* and price effect *(PE)*, CV can thus be rewritten as (Hausman and Leonard 2002):

$$CV = \underbrace{[e(p_i^1, p_{new}^*, \bar{u}) - e(p_i^1, p_{new}, \bar{u})]}_{\text{Variety effect}} + \underbrace{[e(p_i^1, p_{new}^*, \bar{u}) - e(p_i^0, p_{new}^*, \bar{u})]}_{\text{Price effect}} \quad (21)$$

The first term in equation (21) represents the variety effect. The first expenditure function in the variety effect contains the hypothetical (or counterfactual) expenditures in case the new PL tier consumption is zero in the post-introduction period. The second expenditure function in the variety effect denotes the actual (observed) expenditure in the post-introduction period when all the incumbent brands' prices (p_i^1) and the new PL tier's price are observed (p_{new}). The first part in the variety effect ends up with a higher expenditure than the second part since the virtual price of the new PL tier should be high enough to make demand zero and as a result, the reallocation of demand to incumbent brands leads to higher expenditures than the actual expenditure.

The second term in the CV equation represents the price effect which is the difference in category expenditures due to only the price change of the incumbent brands (p_i^1 and p_i^0). The price of the new PL tier is each time set at its virtual price (p_{new}^*) to reflect its absence. This price effect can be either positive or negative. In the end, the CV equation can be written as $CV = (VE + PE)$.

4.4 Empirical Setting

Consumer Welfare Calculation

In order to calculate the CV as it is discussed in the previous section, one should calculate the related expenditure functions in equation (21). Following Hausman (1981), the total welfare effect (CV) can be derived from the expenditure functions as (see also Lin et al. 2012; Hausman and Leonard 2002):

$$CV = \underbrace{\frac{1}{1+\delta}}_{\text{(i)}}[\underbrace{P(p_i^0, p_{new}^*) * Q(p_i^0, p_{new}^*)}_{\text{(ii)}} - \underbrace{P(p_i^1, p_{new}) * Q(p_i^1, p_{new})}_{\text{(iii)}}]. \quad (22)$$

CV then can be calculated by solving the subparts of equation (22). Part (iii) represents the actual (observed) category expenditures, and can be computed using the observed prices in the post-introduction period, p_i^1 and p_{new}. However, to find the values of the parameters in part (i) and part (ii), demand estimation methods are required.

Part (i) can be quantified with the estimation of the category price elasticity δ. Following Gorman's two stage budgeting approach (Gorman 1995; Hausman and Leonard 2002), the top-level demand equation corresponds to overall demand for the soup and cereal category is estimated to obtain overall category level price elasticities. For this, I estimate the following log-log category demand model (see Besanko and Braeutigam 2002; Hausman and Leonard 2002):

$$logQ_{rt} = \alpha_r + \delta logP_{rt} + \varphi Z_t + \varepsilon_{rt}\ , \quad (23)$$

where Q_{rt} is overall category quantity (in volume) in retailer r in week t, α_r is a fixed effect for retailer r, P_{rt} is the category level price index at retailer. Z_t is a vector of control variables which includes a Christmas dummy, seasonal dummies (e.g. winter, summer) and a time trend. Seasonal dummies are included in the model to capture the higher (or lower) consumption due to seasonal conditions. For example, one could expect a higher demand for the soup category during cold

times of the year. In addition to the winter dummy, Christmas dummy is also added in the model which equals one for the week prior to Christmas, in order to capture the New Years' shopping period which is independent from the winter effect. Finally, ε_{rt} denotes an error which is assumed to be i.i.d. normal. Stone index is used to capture the aggregate category level price at the retailer:

$$logP_{rt} = \sum_{i=1}^{I} s_{irt}\, logP_{irt}\ , \tag{24}$$

where s_{irt} is the category value share of each brand i within retailer r at time t.

Part (ii) in equation (22) represents the virtual category expenditures. To estimate virtual category expenditures, prices of the incumbent brands p_i^0 and the virtual price of newly introduced PL tier should be calculated. Since pre-introduction data is observed in this study, prices of the incumbent brands prices p_i^0 are ready to use. However, the virtual price of newly introduced PL tier still needs to be calculated. To do this, I estimate a second level detailed demand system which determines the buying behaviour with respect to brands conditional on total category expenditure within the soup and cereal categories. For this level, a flexible demand specification, which is an almost ideal demand system[36] (AIDS), is estimated (see Deaton and Muelbauer 1981).

$$s_{irt} = \alpha_{ir} + \lambda_i \ln\left(\frac{E_{rt}}{P_{rt}}\right) + \beta_{ii} \ln(P_{irt}) + \sum_{j=1}^{J} \beta_{ij} \ln\left(P_{jrt}\right) + \varphi Z_{rt} + \varepsilon_{irt} \tag{25}$$

$r = 1, \dots, R$ $\quad t = 1, \dots, T$ $\quad i = 1, \dots, I$ $\quad j=1,\dots, J$

where s_{irt} is the expenditure share of the brand i in retailer r and week t, P_{jrt} is the price of the competing brands j in retailer r and week t, P_{irt} denotes the price of the brand i (in this case representing either economy PL or premium PL), P_{rt} is the price index (derived in equation (24)).

[36] The AIDS specification is a first approximation to any demand system. This implies that even if the true underlying demand system is not AIDS, AIDS will nevertheless provide a sufficiently accurate approximation at any set of prices not too far from the point of approximation (Hausman and Leonard 2005).

E_{rt} is the total expenditure on category in retailer r and week t, α_{ir} denotes the retailer-brand fixed effects to capture the time invariant characteristics. Finally, ε_{irt} is an error term and Z_t captures the control variables as before.

Virtual Prices

Given the estimates in equation (25) for the i^{th} brand (i.e. economy PL or premium PL), one can solve for the virtual price of the same brand by calculating the own price elasticities. Then, these estimated elasticities can be used to project virtual prices (Arnade et al. 2011). The virtual prices that are calculated by using the elasticity approach gives more reliable price values compared to the approach of Hausman and Leonard (2002). For example, if the own price elasticity of demand for a new PL tier is -2 (-2.5), then increasing the prices by 50% (40%) will force quantity demanded to zero, all else constant. However, as the previous literature also stated, it is highly expected that the Hausman and Leonard (2002) approach can generate estimates with large variance and some prices can be four or five times the observed new price in the post introduction period (see appendix for details).

In the end, from equation (22), the total welfare effect is calculated which includes both the price and variety effect. To identify the consumer welfare effect due to the variety effect, the following equation is estimated (see Lin et al. 2012):

$$VE = \frac{1}{1+\delta}[P(p_i^1, p_{new}^*) * Q(p_i^1, p_{new}^*) - P(p_i^1, p_{new}) * Q(p_i^1, p_{new})] \,. \qquad (26)$$

After this estimation, PE can be found by subtracting the VE from CV.

4.5 Empirical Results

To calculate the CV, the first top-level demand system is estimated for both categories (equation 4). Results are reported in Table 4-3 for both categories. Because a log-log specification is used, the estimated coefficient on the log price represents the category price elasticity. To estimate this top-level demand equation, pooled OLS is used by controlling the retailer differences with retailer fixed effects together with other control variables[37].

Table 4-3 Top Level demand estimation

Category	**Cereal**	**Soup**
lnPt	-0.776 ***	-0.530 ***
	(0.03)	(0.05)
Trend	1.59E-05	-0.000174
	(0.00034)	(0.00013)
Christmas	-0.537 ***	-0.517 ***
	(0.013)	(0.042)
Spring	-0.0200 ***	0.306 ***
	(0.005)	-0.015
Fall	-0.00454	0.567 ***
	(0.005)	(0.015)
Winter	-0.0757 ***	0.806 ***
	(0.005)	(0.016)
Constant	6.933 ***	-2.813 ***
	(0.19)	(0.416)
Retailer Intercepts	yes	yes
Observations	4,865	3,007
Adjusted R-squared	0.936	0.773
Prob >F	0	0

Standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1

[37] In line with the marketing literature, Christmas dummy and season dummies are added to the model (Lin et al. 2012). Especially, in the soup category, these seasonal dummies indicate that there is higher demand for soup in winter compared to summer months. As a robustness check, instead of these control variables, weekly dummies are added to the model but they also revealed the same insights. Moreover, as a sensitivity check, top level demand is separately estimated for each retailer to see whether the category price elasticity differ across retailers. However, parameter estimates reveal similar magnitude and signs.

The results indicate that the category level price is highly inelastic both in the cereal category ($\beta = -0.77$, p<0.01) and in the soup category ($\beta = -0.53$, p<0.01).

Then as a second step, the AIDS model is estimated to derive the virtual prices for the economy and premium PLs (see Table 4-4). Here, note that AIDS model is estimated without imposing any restrictions on demand model. Hence, instead of estimating each share equation for each brand, I only estimate the share equation for the economy PL and premium PL in the cereal and soup category respectively. This approach is in line with the rest of the marketing literature that supports the rejection of homogeneity and symmetry restrictions (e.g. Deaton 1986, Hausman and Leonard 2002, Lin et al. 2012). In addition to this, marketing literature also shows that the cross effects of NBs ad PLs tend to be asymmetric (e.g. Hökelekli et al. 2017; Allenby and Rossi 1991; Blattberg and Wisniewski 1989).

The left half of the Table 4-4 shows the share equation estimates for the economy PL in the cereal category. All the price coefficients of the competing brands have significant and expected positive signs[38]. For instance, the effect of a price increase of the competing brands such as $ln(P_{Alpen})$ and $ln(P_{Kelloggs})$ on the value share of economy PL is positive ($\beta = 0.00408$, p<0.05; $\beta = 0.00692$, p<0.05), meaning that when the competing brands' price is increased, the demand for economy PL increases. In the soup category, although the effect of price of the competing brands on the value share of premium PL is positive, the effect is only significant for Heinz. For example, the effect of the price increase of $ln(P_{Heinz})$ on the value share of premium PL in the soup category is positive ($\beta = 0.0336$, p<0.1).

[38] As a robustness check, AIDS model is estimated separately for each retailer. Although some of the competing brand price coefficients turn out to be insignificant and different than pooled model results due to limited observations in some retailers (e.g. Somerfield and Safeway), however the coefficient on economy and premium PL remained relatively similar in terms of sign and magnitude. Since these are the core coefficients to estimate the virtual prices, the pooled model was preferred as a final model specification.

Table 4-4 AIDS Model Estimates

	Value share Economy PL in the cereal category			**Value share Premium PL in the soup category**	
$ln(P_{Alpen})$	0.00408	***	$ln(P_{Baxters})$	0.0172	
	(0.001)			(0.026)	
$ln(P_{Nestle})$	0.00744	***	$ln(P_{Campbells})$	0.00908	
	(0.001)			(0.031)	
$ln(P_{Kelloggs})$	0.00692	***	$ln(P_{Heinz})$	0.0336	*
	(0.001)			(0.0179)	
$ln(P_{Weetabix})$	0.00250	*	$ln(P_{Weight\ Watchers})$	-0.029	
	(0.001)			(0.020)	
$ln(P_{Economy\ PL})$	-0.00254	**	$ln(P_{Economy\ PL})$	0.00886	
	(0.000)			(0.012)	
$ln(P_{Standard\ PL})$	0.00837	***	$ln(P_{Standard\ PL})$	-0.0126	
	(0.002)			(0.028)	
ln_E_P	-0.00367	***	$ln(P_{Premium\ PL})$	-0.0237	*
	(0.000)			(0.013)	
			ln_E_P	-0.00513	
				(0.006)	
Trend	-4.90e-05	***	Trend	-0.000256	***
	(0.000)			(0.000)	
Christmas	-0.00183		Christmas	-0.00147	
	(0.001)			(0.015)	
R1	0.0307	***	R1	-0.0621	***
	(0.001)			(0.009)	
R2	-0.00217	*	R2	-0.0500	***
	(0.001)			(0.009)	
R3	0.0019				
	(0.001)				
Spring	2.38E-05		Spring	0.00257	
	(0.000)			(0.005)	
Fall	0.000336		Fall	-0.00349	
	(0.000)			(0.006)	
Winter	-0.000268		Winter	0.0105	
	(0.000)			(0.007)	
Constant	0.229	***	Constant	0.274	
	(0.021)			(0.321)	
Observations	1,006		Observations	219	
Adjusted R-squared	0.807		Adjusted R-squared	0.504	
F test	399.5		F test	15.76	
Prob >F	0		Prob >F	0	

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

The most relevant parameter estimate is the one for the $ln(P_{Economy\ PL})$ in the cereal category which shows that if the price of economy PLs in retailers increases, the value share of the economy PLs within retailers decreases ($\beta = -0.00254$, p<0.05). Similarly, the coefficient estimate for the $ln(P_{Premium\ PL})$ in the soup category indicates that the value share of premium PL and its price are inversely related ($\beta = -0.0237$, p<0.1). Eventually, these parameter estimates are used to calculate the virtual price of the economy PL and premium PL across retailers.

Table 4-5 Descriptive Statistics on Prices (year after the economy and premium PL introduction)

		Asda	Sainsbury's	Safeway	Somerfield
Cereal	Stone Index/Kg (€)	3.19	3.00	3.14	3.19
	Actual Economy PL Price/Kg (€)	1.54	1.03	1.04	1.05
	Virtual Economy PL Price/Kg (€)	2.95	1.53	1.54	1.75
Soup	Stone Index/Kg (€)	1.14	1.40	1.26	N. A
	Actual Premium PL Price/Kg (€)	1.34	1.51	1.76	N. A
	Virtual Premium PL Price/Kg (€)	1.61	2.56	2.27	N. A

Note: The price values, which are calculated per week, were found by averaging over the first year following the PL tier introductions.

Table 4-5 shows the estimated virtual prices of economy and premium PL tiers across retailers. Actual (observed) prices of economy PL tier across retailers are quite comparable (1.04€ per kilo on average). Only Asda prices its economy PL tier more expensive than other retailers (1.54€ per kilo). Note that this is not the case for the virtual prices. Virtual prices vary considerably across retailers. As discussed in the empirical setting section, the elasticity approach was chosen to calculate the virtual price for the economy PL (as well as for the premium PL) for each retailer. For this, the own price elasticity of demand for the economy PL tier is calculated by using the estimated parameters of the AIDS model. Then, this own price elasticity of demand is used to find

out the price level that forces quantity demanded to zero, all else constant[39]. Moreover, it is observed that the price index for the cereal category is higher than the economy PL price across retailers. This shows that the price of economy PLs is far lower than the category average.

If we look at the descriptives on prices in the soup category, it is shown that observed prices of the premium PLs differ considerably across retailers. Safeway prices its premium PL range higher than Sainsbury's and Asda. Asda offers its premium PLs cheapest in the market compared to other retailers' premium PLs. Moreover, the price index for the soup category is consistently lower than the premium PL prices across retailers. This shows that retailers price their incumbent brands well below the premium PL price. Finally, virtual prices of the premium PLs also differ across retailers. Virtual prices of the premium PLs are calculated in a similar fashion that is explained in the economy PL case (see previous paragraph) by using the elasticity approach.

After the calculation of the different components of the CV (equation 22), one can quantify the effect of PL introductions on consumer welfare. Table 4-6 presents the welfare results due to introduction of economy PL in the cereal category and introduction of the premium PL in the soup category. Table 4-6 shows the different components of the total welfare effect by distinguishing the variety effect, price effect and total effect of per household (HH) in the year after the introductions per retailer[40]. The CV calculation suggests that, on average, the utility gain from adding an economy PL tier is worth about 1.71€ to each household over the one-year period. This ranges from 1.36€ in Sainsbury's to 1.98€ in Somerfield.

[39] This approach reveals virtual prices that is reasonable closer to the actual values. On the other hand, the calculation of virtual prices by using Hausman and Leonard (2002) generates estimates with large variance and some prices can be over four or five times the observed new tier price in the post-introduction period (results are shown in the appendix).

[40] Welfare effects per household are calculated by dividing the total CV by the number of unique households per retailer.

Table 4-6 Consumer Welfare Effect for the Year After the PL Introductions across retailers (per household)

	Compensating Variation (CV)			Variety effect	Price effect
	Per HH (€)	Yearly total category expenditure per HH	% of yearly total category expenditure	Per HH (€)	Per HH (€)
Cereal					
Sainsbury's	1.36	50.37	2.70%	0.86	0.50
Asda	1.86	64.13	2.90%	1.19	0.67
Safeway	1.67	71.06	2.35%	1.37	0.30
Somerfield	1.98	94.28	2.10%	1.42	0.56
Soup					
Sainsbury's	1.22	34.85	3.10%	0.88	0.34
Asda	1.35	48.21	2.80%	1.13	0.22
Safeway	0.88	25.88	3.40%	0.70	0.18
Somerfield	N. A	N. A	N. A	N. A	N. A

To provide a basis for household comparison and to provide a more meaningful metric, the household level CV is divided by total expenditure to express this a percentage of expenditure (Kim et al. 2002). When CV is expressed as percentage, it corresponds to 2.51% of the category consumption across retailers. Ranging from 2.10% in Somerfield to 2.90% in Asda. Similarly, it is observed that consumers benefit from premium PL introduction (on average 1.15€ per household across retailers). This corresponds to 2.67% of the category consumption across retailers ranging from 1.70% in Safeway to 3.50% in Sainsbury's. Moreover, the results show that there is a substantial welfare gain if CV is expressed as yearly total category expenditure per household ranging from 50.37€ for the ones who shop in Sainsbury's to 94.28€ in Somerfield in cereal category and from 25.88€ for Safeway shoppers to 48.21€ for Asda shoppers in soup category.

Consistent with the previous literature, the decomposition of the total consumer-welfare effect into price and variety effect shows that the welfare change is mostly driven by the increased variety in both PL tier introductions. The positive price values in price effect column indicate that consumers benefit from the decrease in prices of the existing brands. Moreover, the per household

CV is higher in the introduction of economy PL than the case of premium PL introduction. This proves that the existence of this low-priced option, which would not necessarily be available in the absence of PL, provides more benefit to consumers by compared to premium PLs (Van Herpen and Pieters 2002).

4.6 Discussion and Limitations

The competition issues related to PLs differ depending on the role and the type of PLs and how those compete with NBs or other PLs. In the past, competition authorities have been mainly concerned with the consumer welfare impact of the standard PLs. With the increase of PL tier offerings by retailers, the topic has gained even more attention (Daskolova 2012). For instance, standard PLs act as brand substitutes, but economy and premium PLs may play a complementary role – in the sense that they complete a price range (by offering economy or premium price alternatives) or a product line. Because they can be complements, the findings and conclusions on the competitive or anti-competitive effect of new PL tiers need to be nuanced (Daskolova 2012). Low income consumers can be better served with economy PLs, as well as high income consumers who are looking for specialty high end products can find premium PLs welfare enhancing. Indeed, this study shows that consumers are likely to benefit from new PL tier listings. They both enjoy the reduced prices of the incumbent products as well as increased variety thanks to newly available options.

In this study, the focus was consumers. Previous research has already shown that retailers are also better off with their PL tier introductions since they mostly enjoy higher margins due to better deals with the manufacturers and thus have a lower cost but also due to an increase in store loyalty (Steiner 2004; Geyskens et al. 2010; Ter Braak et al. 2014). To check the general popularity

change of the retailers after their PL introduction, changes in the overall market share are reported in Table 4-9 in appendix. The numbers show that all retailers gained market share after their new PL tier introductions, with the exception of Sainsbury's. Moreover, in line with the expectations, Asda became more popular relative to other retailers after the introduction of economy PL since the economy PL penetration is highest relative to other retailers. This implies the potential win-win situation among consumers and retailers. However, brand manufacturers may potentially suffer, as the competition increases due to new PL listings next to current standard PLs. Hence, as a response to this threat, they might react in a number of ways. One way is to increase their presence in discounter format. Since the discounters also suffer from the economy PL introductions of the traditional retailers, they will use this counter strategy to team up with brand manufactures and create a win-win situation. This strategy has already proven its worth (Deleersnyder et al. 2007 and Hökelekli et al. 2017). Moreover, the brand manufacturers might invest in innovation and offer more varieties in order to differentiate themselves from the PL alternatives (Oxera 2010). To reveal some insights on this, changes in the number of unique NB SKUs are calculated for each retailer one year after the economy and premium PL introductions by the retailers. Table 4-10 in appendix shows that brand manufacturers react to PL tier introductions by increasing their offerings overall, except for the premium PL introduction in Safeway. These numbers also show that the degree of the effect is stronger if the retailer introduce the PL tier with high penetration. For instance, brand manufactures react Asda's economy PL introduction by increasing the number of SKUs by 50%. Again, this might be driven by the fact that economy PL share is higher in Asda relative to other retailers. Similarly, the share of each PL tier product on the total product category differs across retailers, e.g. premium PLs are more important for Sainsbury's than for other retailers. As a result, brand manufacturers introduced 37%

more options in Sainsbury's after the premium PL introduction, considerably more than in other retailers.

This study knows some limitations that offer avenues for further research. First, subject to data availability, future research can evaluate the welfare implications of the economy and premium PL tiers in other categories. This will allow researchers to generalize the findings and reach a concrete overall picture of the effect of PL tiers on consumer welfare.

Second, this study focuses on the additional welfare impact of the PL tiers brings through the variety effect. However, retailers might use these introductions to delist some of the brand variants from the assortment. Future research should focus on the impact of these possible delistings.

Third, in this study, consumer welfare effects are analysed at the retailer level by using aggregate national level data. Since retailers in the U.K. follow a national pricing scheme, consumers are faced with same prices in each region. However, future studies may investigate the welfare effects by controlling the consumer demographics. In this way, they can quantify the effect of PL tier introductions on different consumer segments (Hausman and Leibtag 2007). This is especially important in this case since one would assume that the different social classes or income holders can be differently affected by the economy and premium PL introductions since the effect depends on their respective shopping basket.

Finally, this study doesn't control the reactions of the retailers to each other's PL introductions. The strongest competitive constraint on the retailers' pricing could come from other retailers' pricing decisions on NBs as well as PL tiers. Future studies should also assess the spillover effects and investigate the consumer welfare effects due to the retailers' reactions to each other.

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Appendix

Table 4-7 Literature overview – impact on consumer welfare

	References	Retailer entry	NB entry	Standard PL entry	PL Tier Economy PL entry	Premium PL entry
Introductions at traditional retailers	Hausman and Leibtag (2007)	x				
	Pauwels and Srinivasan (2004)			x		
	Bonfrer and Chintagunta (2004)			x		
	Haausman and Leonard (2002)		x			
	Arnade et al. (2011)		x			
	This study				x	x
Introductions at discounters	Lin et al. (2012)		x			

Virtual Price Calculation by using Hausman and Leonard (2002) approach

Given the estimates of the equation (25) for the i^{th} brand (i.e. economy PL or premium PL), one can solve for the virtual price of the same brand by inverting the share equation (25). After that, p^*_{new} (representing the virtual price of economy and premium PL tier) can be calculated by making the consumption (demand) is zero ($s_{irt} = 0$) for these tiers in equation (25):

$$p^*_{new} = \left(\frac{\hat{\alpha}_{ir} + \sum_{j \neq i}^{J-1} \hat{\beta}_{ij} \ln(P_{jrt}) + \hat{\lambda}_i \ln\left(\frac{E_{rt}}{P_{rt}}\right)}{-\beta_{ii}} \right) \quad (27)$$

However, as the previous literature also stated, it is highly expected that the above approach can generate estimates with large variance and some prices can be four or five times the observed new price in the post introduction period as reported below:

Table 4-8 Virtual Prices by using Hausman and Leonard (2002)'s approach

	Asda	Sainsbury's	Safeway	Somerfield
Virtual Economy PL Price/Kg (€)	4.23	3.60	4.83	5.70
Virtual Premium PL Price/Kg (€)	2.56	1.07	1.98	N.A.

Descriptive Statistics after the PL tier introductions

Table 4-9 Market share (%) before and after PL tier introductions

		Asda	Sainsbury's	Safeway	Somerfield
Cereal	Market share before (%)	17.18	29.79	12.74	2.16
	Market share after (%)	19.07	27.02	12.84	3.25
	Δ (percentage point)	**+1.89**	**-2.77**	**+0.10**	**+1.09**
Soup	Market share before (%)	23.73	24.67	16.65	N.A.
	Market share after (%)	27.73	25.89	17.32	N.A.
	Δ (percentage point)	**+4.00**	**+1.22**	**+0.67**	**N.A.**

Table 4-10 Number of SKU change in NBs before and after PL tier introductions

		Asda	Sainsbury's	Safeway	Somerfield
Cereal	# of NB SKUs Before	104	122	83	89
	# of NB SKUs After	158	144	99	128
	Δ in SKUs	**+54**	**+22**	**+16**	**+39**
Soup	# of NB SKUs Before	135	161	235	N.A.
	# of NB SKUs After	166	222	204	N.A.
	Δ in SKUs	**+31**	**+61**	**-31**	**N.A.**